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L.L. LAUGHLIN, JR., Ph.D.

MISCELLANEOUS PUBLICATION 25

A STUDY OF THE VULNERABILITY OF SUBWAY PASSENGERS IN NEW YORK CITY
TO COVERT ATTACK WITH BIOLOGICAL AGENTS [REDACTED]

SHORT TITLE: Test Tube Study: I. Results of Tests (U)

Special Operations Division
COMMODITY DEVELOPMENT AND ENGINEERING LABORATORY

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L.L. LAUGHLIN, JR., Ph.D.

ABSTRACT

A series of trials was conducted to evaluate the vulnerability of subway systems to covert biological attack. The trials were conducted in three major north-south subway lines within an approximate 2-square-mile area of mid-Manhattan, New York City. A harmless simulant biological agent was disseminated both within the subway tubes and from the street into subway stations. Dropping an agent device onto the subway roadway from a rapidly moving train proved an easy and effective method for the covert contamination of portions of subway lines. Agent delivered in this manner was aerosolized and dispersed rapidly by the movement of trains, penetrating stations and trains in the area and persisting there for one hour or more. Dissemination of agent into subway stations via the air intake grills at street level also proved feasible, although the degree of contamination and persistence were lower, primarily because of the smaller amounts of agent disseminated in the trials with this method. Conversion of the simulant data from the trials to equivalent data for pathogenic agents indicated that similar covert attacks with a pathogenic agent during peak traffic periods could be expected to expose large numbers of people to infection and subsequent illness or death. Although complete protection of subways against covert biological attack probably cannot be provided under any circumstances, the hazard probably can be reduced by education plus expanded security measures.

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1. INTRODUCTION

(U) Underground railroad systems (subways) were developed as the most efficient and rapid means of transporting the working population of large urban centers from their homes to their places of business. Many major cities have subway systems, and new systems are being considered by others. In Europe, subway systems exist in Barcelona, Berlin, Budapest, Glasgow, Hamburg, London, Madrid, Oslo, Paris, Rome, and Stockholm. Subways also have been constructed in Osaka and Tokyo, Japan, Sydney, Australia, and Buenos Aires, Argentina. Russia has subway systems in Moscow, Leningrad, Kiev, Tiflis and Baku. In North America, there are subway systems in Boston, Chicago, Cleveland, New York City, Philadelphia, and Toronto. A system is under construction in San Francisco, and one is planned for Washington, D.C. These cities are centers of finance, commerce, or government in their respective countries, and the subway lines are daily places of concentration of the people who carry out these activities.

Foreign countries have considered the vulnerability of people in subway lines to covert attack with chemical and biological agents. Prior to World War II, the Germans considered dissemination of biological agents in the Paris and London subways as a means of attacking the civilian population in those cities.

In North America, the freedom of movement of people makes subway systems readily accessible to enemy agents. Covert dissemination of biological agents in a subway would be silent and invisible, and, if it spread in the system, large numbers of people would be exposed. Simultaneous widespread outbreak of illness in the working population of a number of key cities would overwhelm medical and public health facilities, have great psychological impact, cause diversion of medical and other resources to the disaster area to meet the emergency, and possibly affect the ability of this country to react at a critical time.

A study of the vulnerability of a segment of a subway system to covert attack was undertaken to provide information on (i) agent distribution and concentration in order to assess threat of infection to subway passengers, (ii) ease of agent dissemination in the system, and (iii) methods of delivery that could be used offensively. The subway lines in mid-town New York City were selected for investigation because of the heavy traffic and the number of lines available for tests. This report details the design, conduct, and results of the tests.

GENERAL PROCEDURES

A. (U) DESCRIPTION OF TEST SITES

(U) The test area in mid-town New York City is shown in Figure 1. The site is about two square miles of the main business section of Manhattan Island, extending from 14th Street on the south to 59th Street on the north and from Lexington Avenue on the east to Eighth Avenue on the west.

(U) Four subway lines traverse the area in a north-south direction. They are the Lexington Avenue line on the east side, the Sixth and Seventh Avenue lines in the central area, and the Eighth Avenue line on the west. Each line has four tracks, two tracks for uptown (northbound) local and express trains and two tracks for downtown (southbound) trains. The length of the individual test lines in the area is approximately 2.1 miles. The volumes calculated for the four underground tubes range from 15.5 to 16.7×10^6 cubic feet or 4.4 to 4.73×10^8 liters. Stations where only local trains stop generally have passenger platforms at each side of the station. Stations where both local and express trains stop generally have a third platform between the two inside tracks for express train passengers. The volume calculated for local stations is about 1.35×10^6 cubic feet, or 3.8×10^7 liters, and that for the larger stations handling both types of trains is 1.88×10^6 cubic feet or 5.3×10^7 liters.

(U) Statistical data show that approximately one million workers used subways in the mid-Manhattan business district daily in 1965 to reach their work. These workers included merchants, manufacturers, tradesmen, professional people, government employees, technicians, and artisans of every type. Approximately 75% of these workers arrive and leave their work during 1½-hour periods in the morning and evening, producing peak traffic periods in the area subway lines on work days from about 0745 to 0915 in the morning and 1615 to 1745 in the evening.³

B. (U) AEROSOL GENERATION

(U) Table 1 shows the general plan of the subway trials. There were two types of trials: those in which aerosol was generated in subway tubes by the movement of trains (Tests I, II, IV), and those in which agent was disseminated directly into subway stations (Tests III and V). A harmless simulant agent, Bacillus subtilis var. niger, in the form of a dry powder, was used in all tests. The viable count of the product was 5.0×10^{11} organisms per gram. For aerosol generation in the subway tube, the agent receptacle was a light bulb containing a mixture of 175 grams of dry B. subtilis spores and 30 grams of charcoal (Fig. 2). The charcoal was used to darken the agent and make the deposit less noticeable on the roadbed.

TABLE 1. ~~SECRET~~ GENERAL PLAN OF SUEWAY VULNERABILITY TRIALS (U)

Test No.	Subway Line	Agent ^{a/} Disseminated, grams	Method of Dissemination	Samplers		Car Registration ^{b/}	T and RH ^{c/}
				Fixed Position	Mobile (Train)		
I	Lexington Ave.	175	Agent device ^{d/} onto tracks	8 stations 11 platforms	6	Yes	Yes
II	Seventh Ave.	175	Agent device ^{d/} onto tracks	8 stations 11 platforms	4	Yes	Yes
III	Eighth Ave.	40	E40 through street grills ^{e/}	6 stations 11 platforms	4	Yes	Yes
IV	Lexington Ave.	175	Agent device ^{d/} onto tracks	8 stations 11 platforms	6	Yes	Yes
V	Seventh Ave.	40	E40 through street grills ^{e/}	6 stations 11 platforms	5	Yes	Yes

a. Agent: Bacillus subtilis var. niger.

b. Number of first and last car of each train.

c. Temperature and relative humidity.

d. Agent device: Each light bulb containing 175 g Bacillus subtilis plus 30 g activated charcoal.

e. ~~Each E40 was filled with 2.5 g agent.~~ E40's were employed; each E40 was filled with 2.5 g agent.

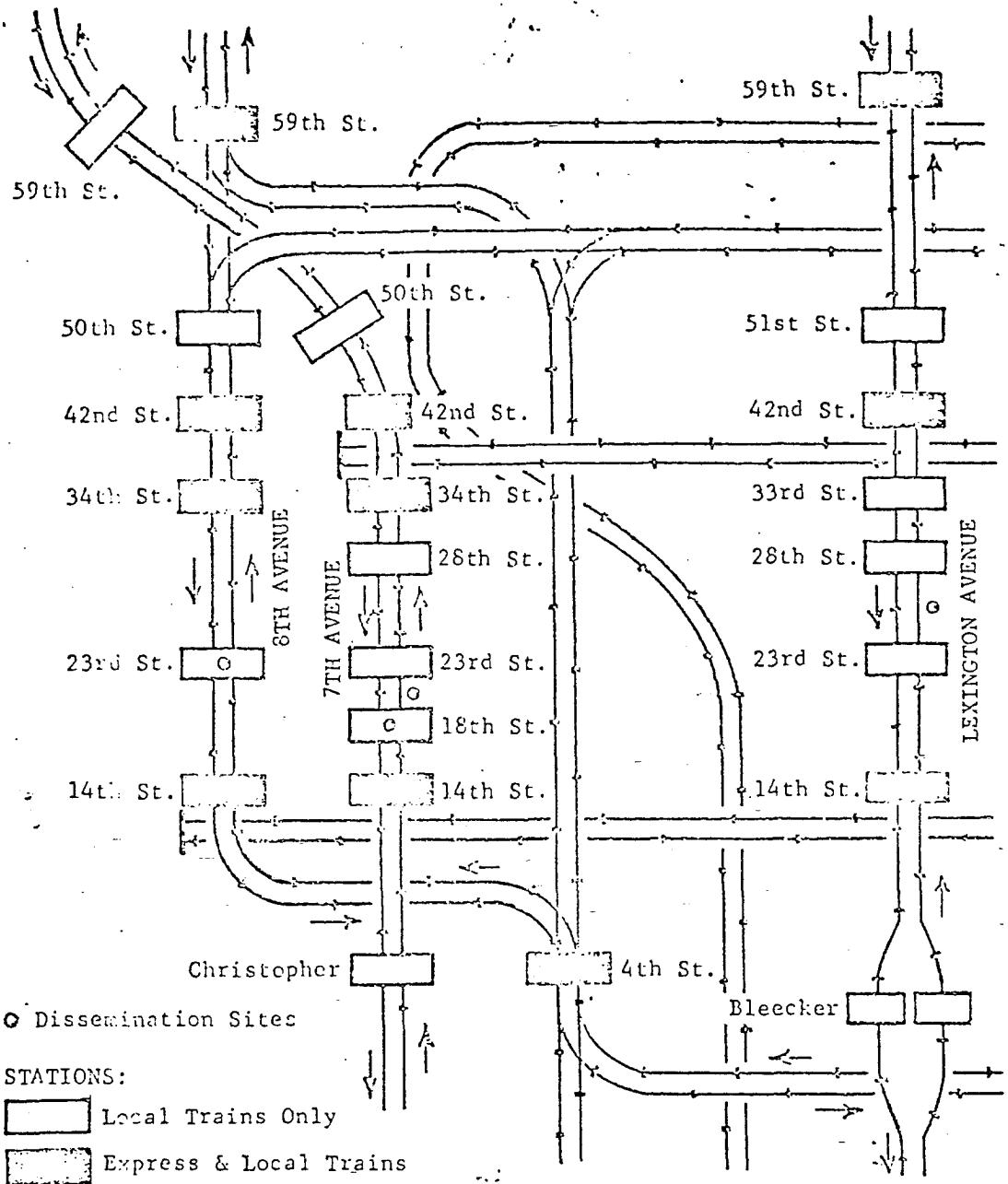


Figure 1. Area of the Subway Tests. (U)

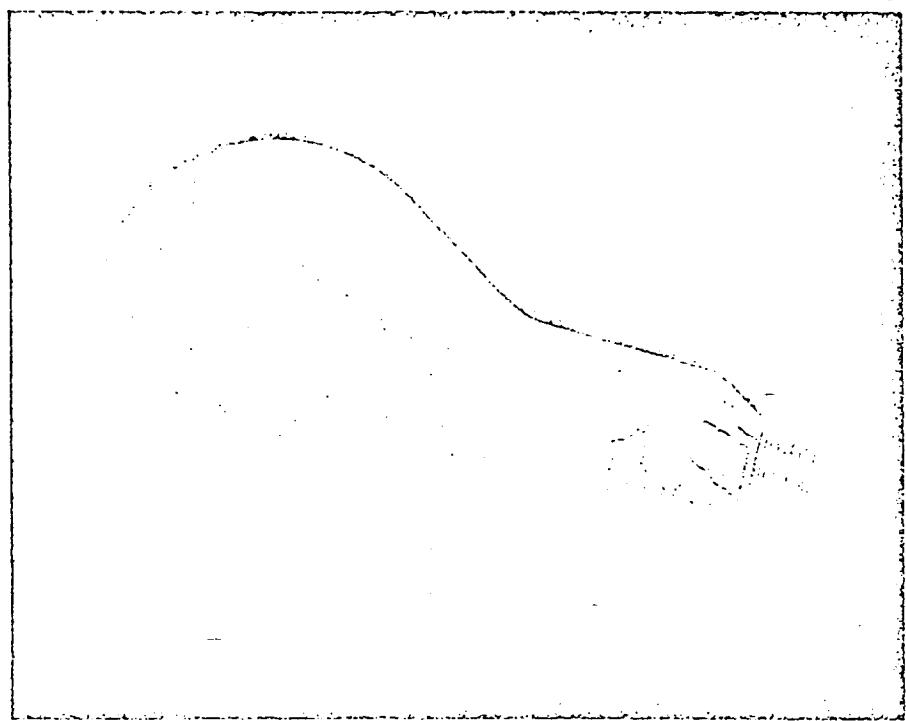


Figure 2. Device Used to Disseminate Agent
in Subway Tubes. (U)

1. **█** Generation of Aerosol in Subway Tube

█ Aerosols were generated in subway tubes by movement of trains over deposits of agent on the roadbed. The agent was deposited on the roadbed of express trains. These trains make fewer stops and travel at higher speeds than local trains and aerosol generation therefore might be greater with the faster moving trains.

made its first stop.

2. **█** Generation of Aerosol into Subway Station

█ Most subway stations in the test area are ventilated through side walk gratings. These gratings are usually located near the curb on each side of the street and parallel the street for a distance of approximately three city blocks. Gratings on the east side of the street ventilate the uptown side of the station and those on the west ventilate the downtown side. A cross-section of one side of a typical station is shown in Figure 5. Trains approaching the station push air out of the station through the gratings, and those departing cause air to flow into the station. Concrete aprons located approximately 4 feet below the gratings protect passengers on the station platform from water or debris, which might fall off the train from the street.

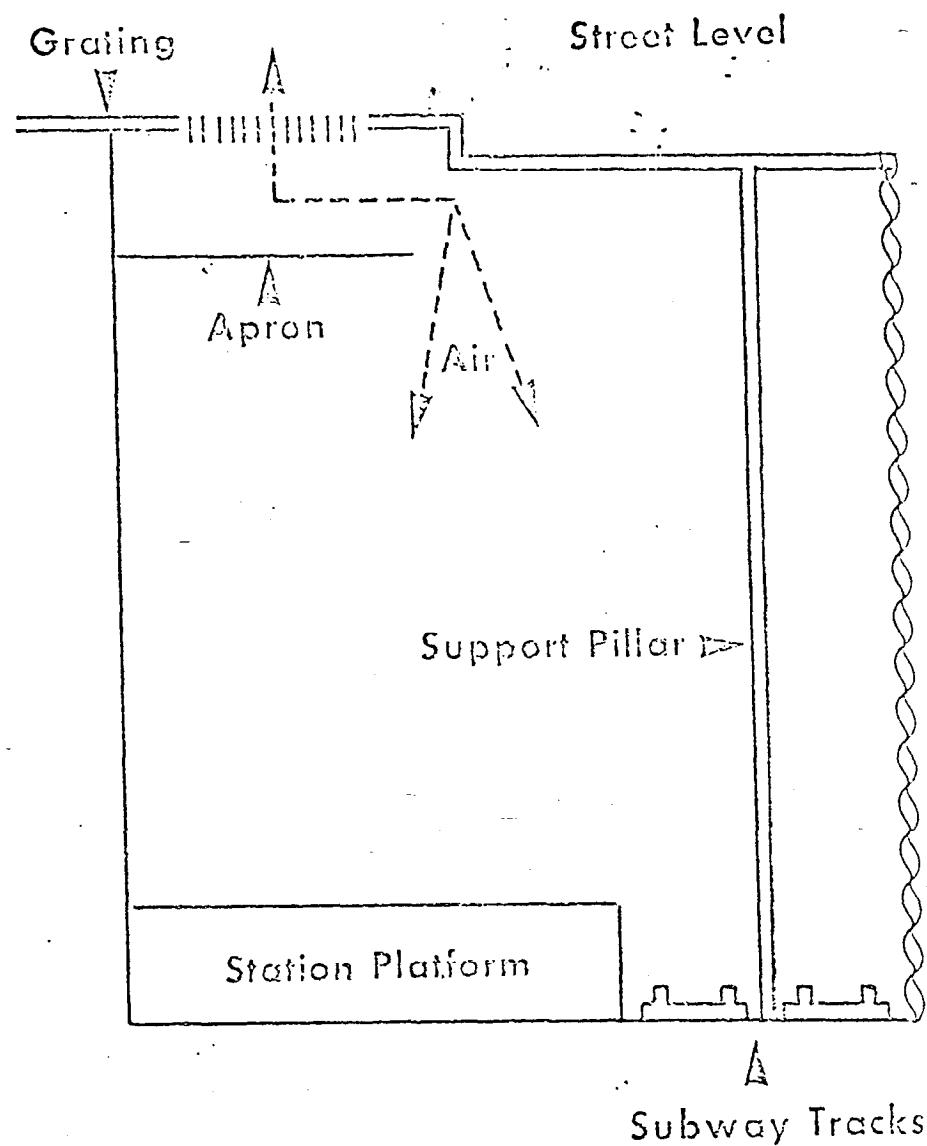


Figure 5. (U) Cross-Section of One Side of a Subway Station. (U)

1)

C. ~~U~~ AIR SAMPLE COLLECTION

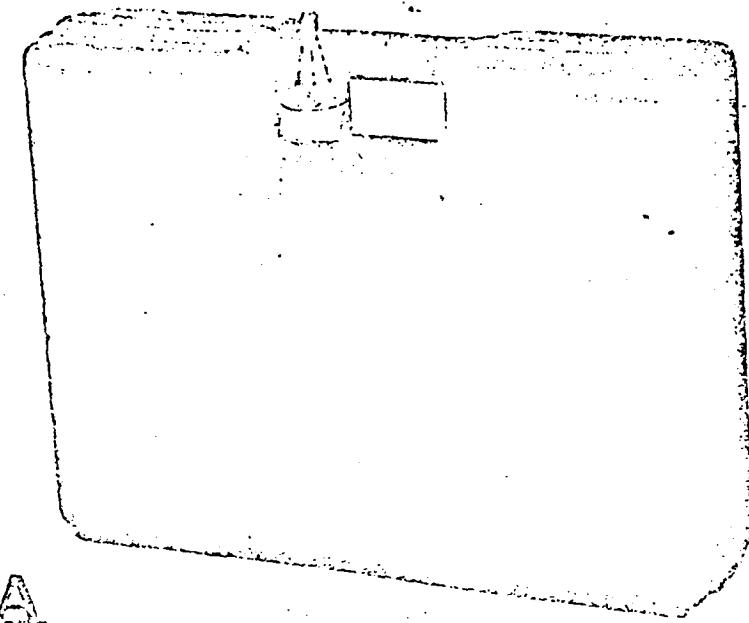
Air samples were collected in all stations in the test area and also in trains passing through the area for approximately 2 hours after agent dissemination began. Samples were collected in subway stations to obtain information on the spread of agent in the tube from the point of dissemination and its persistence in the different stations. Other personnel collected air samples in local and express trains to obtain information on concentration of agent in area trains at different time periods after agent dissemination. In the tests in which agent was disseminated in the subway tube, the operative who dropped the light-bulb munition to the roadbed also collected air samples from the time of the drop until he reached the street to obtain information on his exposure to organism from this operation.

(ii) Portable, self-contained air pumps fitted with In-Line Filter Paper (Wagner) Samplers were used for sample collection.⁴ In some instances, Mighty Mite pumps were operated in plastic carrying cases for sample collection (Fig. 7,A). In others, Physical Defense Division pumps and Wagner samplers were concealed in leather camera bags (Fig. 7,B). Each pump was calibrated with Wagner collectors to determine air-flow rate before and after each test. Whenever a difference in rate was recorded, an average figure was used as the flow rate for that test.

In tests in which agent was disseminated in the subway tubes (Table 1), air samples were collected in eight stations. Station sampling locations are shown in Figures 1 and 2, Appendix A. Schedules for sample collection in stations and trains in these trials are given in Appendix A, Tables 1 to 6. In the tests in which agent was disseminated into subway station through sidewalk ventilation gratings, air samples were collected extensively in six stations (Table 1). Station platforms on which samples were collected are indicated in Figures 3 and 4, Appendix A. Schedules for sample collection in stations and trains are given in Appendix A, Tables 7 to 12.

D. (U) SAMPLE ASSESSMENT

(U) All air samples collected in each test were returned to Fort Detrick immediately after the test for assessment. Suspensions were prepared from the filter paper pads and dilutions plated in triplicate on agar medium. Colonies on plates of appropriate dilutions were counted and the average counts used to determine total count per sample. The number of organisms per liter of air was based on the volume of air sampled.



A

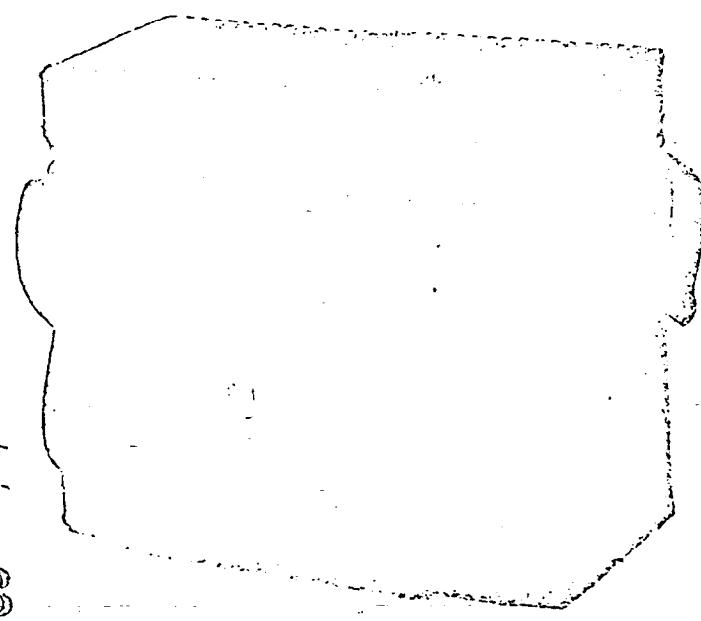


Figure 7. (U) Air Sampling Equipment. A, In-Line Filter Paper Sampler with pump in plastic case; and B, same sampler and pump concealed in leather camera case. (U)

III. RESULTS

A. ~~DISSEMINATION OF AGENT IN SUBWAY TUBES~~

~~E~~ The results of the three tests in which agent was disseminated between stations in the subway tubes are given in Tables 1 to 6, Appendix C. Agent recoveries from air samples are presented in terms of organisms inhaled by humans per minute exposure at the given locations. A breathing rate of 10 liters per minute was used for computing human exposure.

~~E~~ Penetration of agent into stations in the three tests is given in Tables 1, 3, and 5, Appendix C. The data show that agent aerosolized from the roadbed by the movement of trains spread rapidly along the tubes in both directions. Agent was detected at seven of the eight stations within 5 minutes after deposit of agent in both tests on the Lexington Avenue line (Tables 1 and 3, App. C) and within 10 minutes in the test on the Seventh Avenue line (Table 5, App. C). Recoveries from air samples indicated that agent persisted in stations for at least 1½ to 2 hours. Agent concentrations reached their maximum in most stations within the first 15 to 30 minutes. On the uptown side, high concentrations occurred and persisted longest on the uptown side between the 23rd and 42nd Street Stations and on the downtown side between the 28th and 14th Street Stations.

(U) Tables 2, 4, and 6, App. C show the penetration of agent into coaches and the exposure of people riding trains in the three tests. The time (street-to-street) that test personnel riding express trains spent in the subway lines ranged from a minimum of 4 to a maximum of 17 minutes, the most frequent time period being 7 to 9 minutes. The times recorded for local train riders was 4 to 13 minutes, with the most frequent time period ranging from 8 to 10 minutes. High exposure doses generally occurred within the first 40 minutes after agent dissemination. They were most frequent on local uptown trains

se

~~E~~ Air samples indicated that the operative who dropped the agent package from the train received little exposure after its release. No agent was recovered from samples collected by the operative in Test 1 (Table 2, App. C), and counts were low in Test 2 (Table 6, App. C). In Test 4, the high count in the control sample indicated contaminated clothing or equipment (Table 4, App. C). Except for this contaminated

sample, other control samples in the second Lexington Avenue test were zero or near zero, indicating relatively low concentration of agent in stations and trains after 2 days.

B. **DISSEMINATION OF AGENT INTO SUBWAY STATIONS**

The spread of agent in subway lines following introduction into stations is shown in Tables 7 to 10, Appendix C. The data show that the agent aerosol was maintained in the target stations during the period of dissemination and was spread to stations along the tube by movement of trains. Distribution was similar to that from agent deposit, except that it was more limited because of the smaller quantity of agent disseminated. Agent was recovered in air samples in all but one station in the test on the Eighth Avenue line within the first 5 minutes after dissemination was initiated (Table 7, App. C), and in all stations in the test on Seventh Avenue (Table 9, App. C). Concentrations generally were highest in target stations and at nearby uptown stations on the uptown side and downtown stations on the downtown side.

Agent also penetrated all trains passing through the dissemination area (Tables 8 and 10, App. C). Exposure doses were generally lower in express than in local trains because express trains did not stop at target stations and because of the short exposure period. The exposure periods on express trains ranged from 3 to 6 minutes, on local trains from 2 to 10 minutes.

C. **SUBWAY TRAIN MOVEMENTS AND ENVIRONMENTAL CONDITIONS DURING TESTS**

A record was kept of trains passing the 14th Street Station in each test to identify trains returning through the area one or more times during the test period (App. B, Tables 1 to 5). The car numbers of both first and last cars in each train were recorded in case some cars were dropped from either end of a train on its return trip. Temperature and relative humidity readings also were recorded at representative subway stations in each test (Table 2).

TABLE 2. (U) SUBWAY METEOROLOGICAL CONDITIONS^{a/} (U)

Test No. and Date	Clock Hour	Station Location	Temp. Dry Bulb, F	RH %
I/7 June 66	0910	14th, Lexington Ave.	86	57
I/7 June 66	1045	42nd, Lexington Ave.	87	53
I/7 June 66	1055	51st, Lexington Ave.	86	50
I/7 June 66	1120	Street Level	82	49
II/8 June 66	0855	18th, Seventh Ave.	81	57
II/8 June 66	1005	18th, Seventh Ave.	81	51
II/8 June 66	1000	28th, Seventh Ave.	84	49
II/8 June 66	1100	28th, Seventh Ave.	83	49
II/8 June 66	1045	59th, Seventh Ave.	85	48
II/8 June 66	1145	59th, Seventh Ave.	87	50
III/9 June 66	0845	14th, Eighth Ave.	81	57
III/9 June 66	0900	14th, Eighth Ave.	80	54
III/9 June 66	0930	14th, Eighth Ave.	80	54
III/9 June 66	1000	14th, Eighth Ave.	80	54
III/9 June 66	0850	50th, Eighth Ave.	-b/	59
III/9 June 66	0950	50th, Eighth Ave.	-	51
III/9 June 66	1030	50th, Eighth Ave.	-	51
IV/9 June 66	1300	14th, Lexington Ave.	84	49
IV/9 June 66	1340	14th, Lexington Ave.	86	47
IV/9 June 66	1345	28th, Lexington Ave.	87	49
IV/9 June 66	1415	28th, Lexington Ave.	86	50
IV/9 June 66	1505	28th, Lexington Ave.	87	53
IV/9 June 66	1312	59th, Lexington Ave.	-	62
IV/9 June 66	1330	59th, Lexington Ave.	-	62
IV/9 June 66	1500	59th, Lexington Ave.	-	63
V/10 June 66	0845	Chris., Seventh Ave.	84	61
V/10 June 66	0945	Chris., Seventh Ave.	82	64
V/10 June 66	1030	Chris., Seventh Ave.	- 84	62
V/10 June 66	0855	28th, Seventh Ave.	-	75
V/10 June 66	0955	28th, Seventh Ave.	-	76
V/10 June 66	1028	28th, Seventh Ave.	-	75

a. The measurements were made with a Taylor Humiguide. The range of conditions during the test were: temperature, 80 to 87 F; relative humidity, 48 to 76%.

b. - = Not done.

(U) Repassage of subway trains through the test area occurred in all tests. Repassage was most frequent and quickest among local downtown trains. In all tests, a substantial number of these local downtown trains returned through the test area 15 to 25 minutes later as uptown locals. In the tests conducted on the Lexington Avenue line, a few of these uptown locals also made a third passage through the area about 90 minutes later as downtown locals, completing the circuit (Tables 1 and 4, App. B). In contrast to local trains, return passage among express trains was most common in uptown trains. In all tests, some uptown trains made a second passage through the area 60 to 90 minutes later as downtown trains. Repassage by downtown express trains, however, was relatively rare; it was observed only in tests on the Seventh Avenue line (Tables 2 and 5, App. E). No complete circuits by express trains were recorded.

(U) The tests were held 6 to 10 June 1966, and the weather was warm in the subw.v. The temperature was above 80 F, and the relative humidity ranged from about 50 to 75% (Table 2). Windows were open and fans were operating in the cars on all trains. Circulation of air appeared to remove most agent residual from cars before return to the test area, even in downtown local trains where the time before return to the area was shortest. An air sample was collected on at least one train making a second passage through the area as an uptown local in each test (Tables 1-5, App. B). Agent recoveries in these samples gave no indication of significant agent residual (Tables 2, 4, 6, 8, and 10, App. A).

D. ~~C~~ TEST ARRANGEMENTS

(S) The several trials were conducted as completely independent operations without the knowledge or cooperation of the New York City Transit Authority or Police Department. Dissemination of agent and collection of air samples attracted no attention, and the tests were carried out without incident. Agent was disseminated without challenge or apparent detection. Air sampling was conducted more or less openly; it elicited few inquiries and no suspicion. Test personnel were given letters identifying them as members of an industrial research organization as a cover in case they were questioned. They were not used, except by one person who smoked in a station. He used his letter to prove nonresidency to a police officer. Following this, he completed sample collection without further questioning. A list of test personnel and reports of their experiences during tests are given in Appendix D.

IV. ~~SECRET~~ DISCUSSIONA. ~~SECRET~~ ESTIMATES OF EXPOSURES TO PATHOGENIC AGENTS BASED ON SIMULANT RECOVERY

~~SECRET~~ Test results show that a large portion of the working population in downtown New York City would be exposed to disease if one or more pathogenic agents were disseminated covertly in several subway lines at a period of peak traffic. Distribution and persistence of test organism in individual subway lines were determined by collection of air samples in stations. Agent recoveries are presented in terms of inhaled organisms per minute exposure. These inhalation figures were calculated on a breathing rate of 10 liters of air per minute, which is generally considered the minimum rate for man. The estimated respiratory exposure or infective dose (LD_{50} or ID_{50}) for man of pathogens currently under investigation as disease agents range from about 10 to several thousand organisms.⁵ ~~SECRET~~ Anthrax for man is

~~SECRET~~ B. subtilis var. niger was used as the test agent. This organism is harmless to man. It was available in dry form, which is very important in covert test operations. Also, it could be collected by equipment that attracted little attention during operation in public places. Furthermore, data are available on the relative dissemination rates of B. subtilis

B. ~~2~~ TUBE DISSEMINATION OF AGENT

~~2~~ Dissemination of agent from deposits on the roadbed was successful in the three trials in which this method was used. Aerosol generated by the movement of trains spread rapidly through all test subway lines (Tables 1, 3, and 5, Appendix C). Agent penetrated test trains and all stations and persisted there generally in relatively high concentrations for 1½ to 2 hours. Agent recoveries were consistently low only in the 51st Street Station in the Lexington Avenue line and the 50th Street Station in the Seventh Avenue line. ...

~~2~~ The most frequently occurring time periods spent by test personnel in travel in trains and stations in these tests ranged from 7 to 10 minutes. People remaining in the area for a similar time would have run great risk of infection

~~2~~ Risk of infection and exposure levels would have been highest for personnel using the subway near the site of agent dissemination and within the first hour after dissemination.

P.

C. ~~SECRET~~ STATION DISSEMINATION OF AGENT

~~SECRET~~ Dissemination of test agent into subway stations produced high concentrations of agent in target stations, but spread and persistence of agent in the lines were limited by the small quantity of agent used (Tables 7 to 10, App. C). Only 40 grams of agent were aerosolized into the respective stations in contrast to the approximately 175 grams of agent used per test for tube dissemination. The effect of train movement on spread of the aerosol, in an uptown direction by uptown trains and downtown by downtown trains, was most marked. The average time spent by personnel in trains and in these tests was about 6 minutes.

~~SECRET~~ Shows the high risk of infection to subway passengers in the target and nearby stations and trains in the area during dissemination of agent. However, agent concentrations decreased rapidly after dissemination ceased and risk of infection would have been low after 1 hour.

E. ~~SECRET~~ COUNTERMEASURES

~~SECRET~~ Although covert dissemination of a biological agent in the New York City subway system probably cannot be prevented under present conditions, the following countermeasures might reduce the hazard:

- 1) Include information on covert use of biological agents and likely ways of dissemination in the training of police and subway personnel.
- 2) Instruct train operators, track maintenance, and other subway personnel to be alert and look for signs of covert use of biological agents during high risk periods.
- 3) The ordinance against smoking in trains and stations is strictly enforced. Similar enforcement of an ordinance against litter would make clandestine deposit of agent in the system more difficult.
- 4) At critical political periods, an increase could be made in the number of station inspections, patrols of tracks, and trainmen on trains. Also, doors of coaches could be locked to prevent movement of passengers between coaches.
- 5) Collection of air samples at one or more locations in downtown subway lines at peak workday traffic periods.
- 6) Immunization of key personnel with vaccines available for potential biological agents and establishment of a volunteer immunization program for other workers. Vaccines exist for many potential biological agents, but are not generally used in this country. Mass immunization techniques have been successfully applied against natural diseases, such as smallpox and poliomyelitis.

V. ~~SECRET~~ CONCLUSIONS

~~SECRET~~ Data obtained in the present study indicate that personnel using subway lines in mid-town Manhattan are highly vulnerable to covert attack with biological agent. Dropping an agent package to the roadbed from a rapidly moving train is an easy and effective method for covert contamination of a segment of a subway line with biological agent. Agent release can be arranged so that risk of infection to the operator is low. Agent delivered in this manner is aerosolized and dispersed rapidly by the movement of trains, penetrating stations and trains in the area and persisting there for one hour or longer. Distribution and concentration of agent in the subway line is dependent on the amount of agent deposited on the roadbed. Simultaneous or near simultaneous deposit of a pathogenic agent in one or more locations in each of the several subway lines operating in mid-town Manhattan at a peak workday traffic period would expose a large number of people to infection and cause high casualties among the population working in the area. Although complete protection against covert biological attack cannot be provided under present conditions, the hazard probably could be reduced by education and expansion of security measures to include attacks of this type.

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* Symbol deleted.

APPENDIX A

(U) SAMPLING LOCATIONS AND SCHEDULESFIGURES

1. Drop Point and Station Sampling Locations on Lexington Avenue Line, Tests I and IV	33
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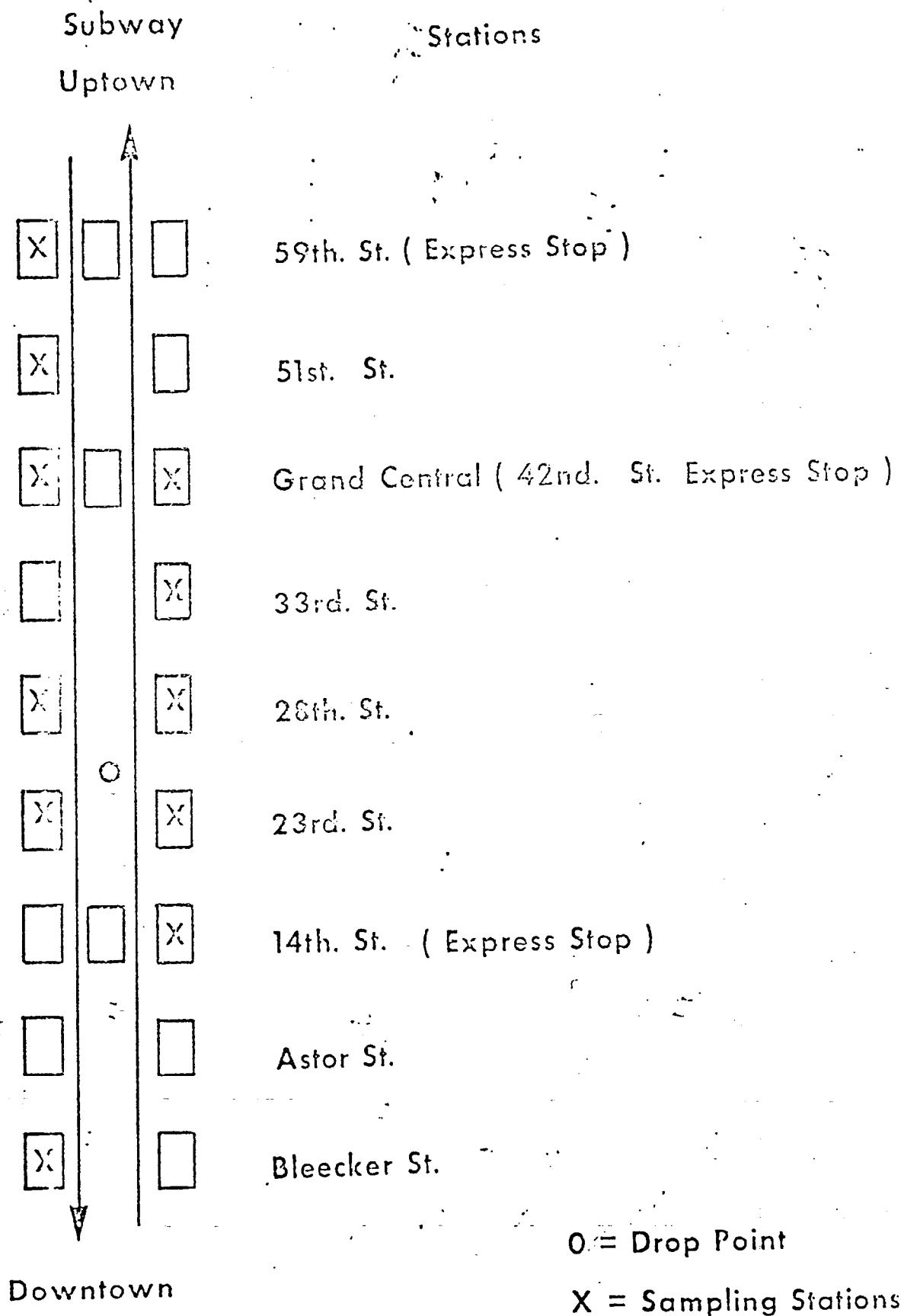


Figure 1. (U) Drop Point and Station Sampling Locations on Lexington Avenue Line, Tests I and IV. (U)

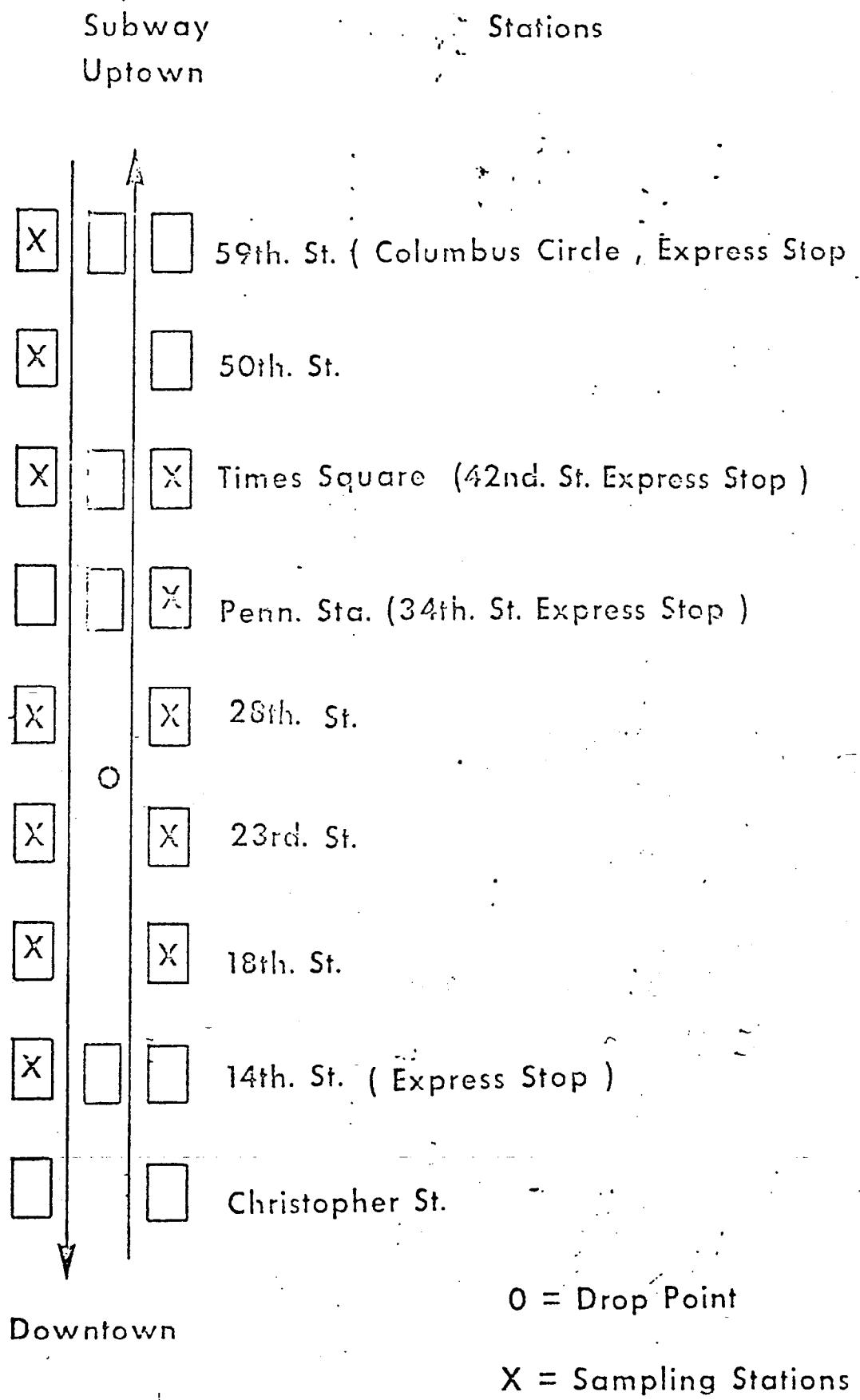


Figure 2. (U) Drop Point and Sampling Stations on
Seventh Avenue Line, Test II. (U)

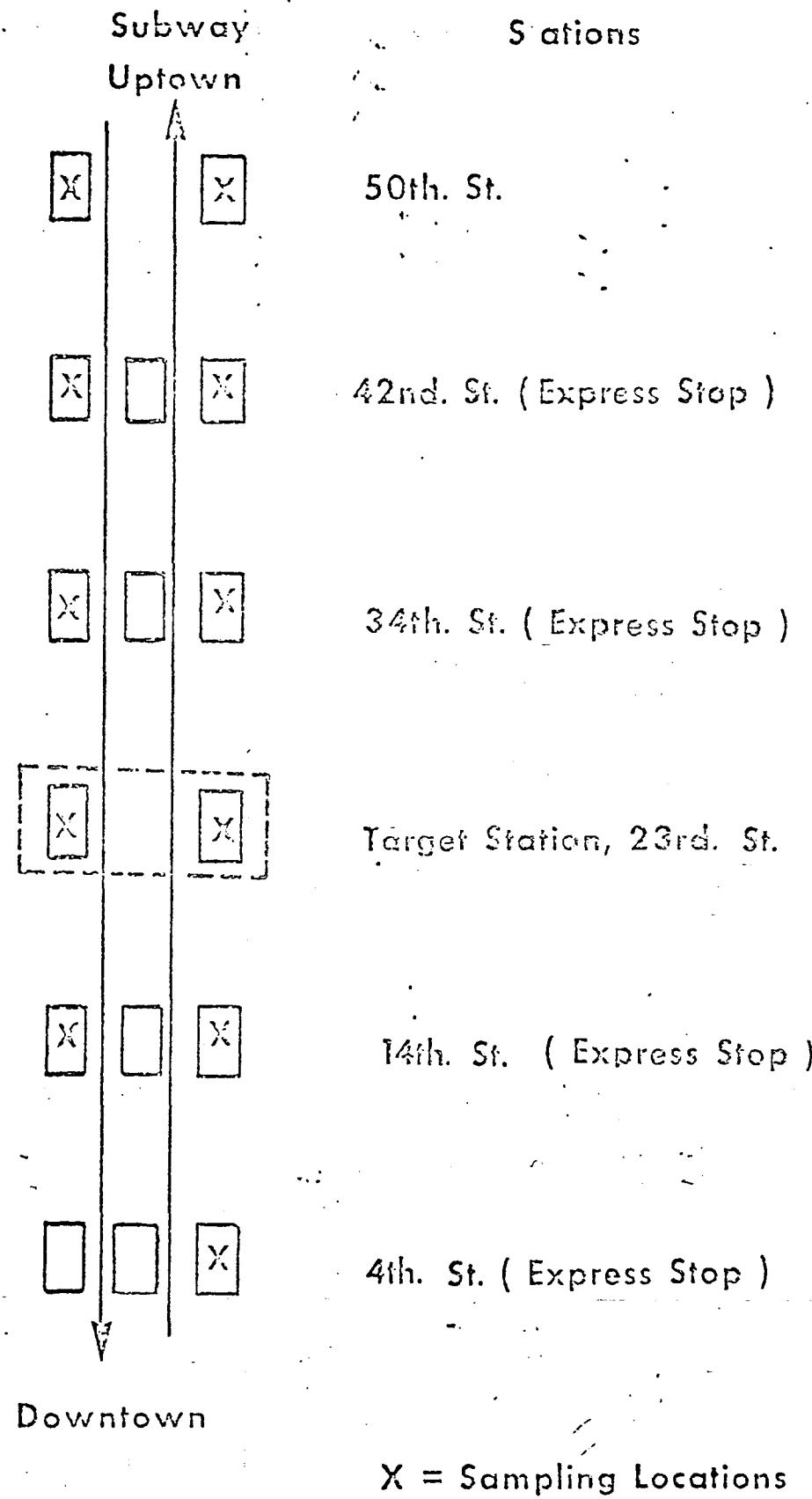


Figure 3. (U) Target Station and Station Sampling Locations on Eighth Avenue Line, Test III. (U)

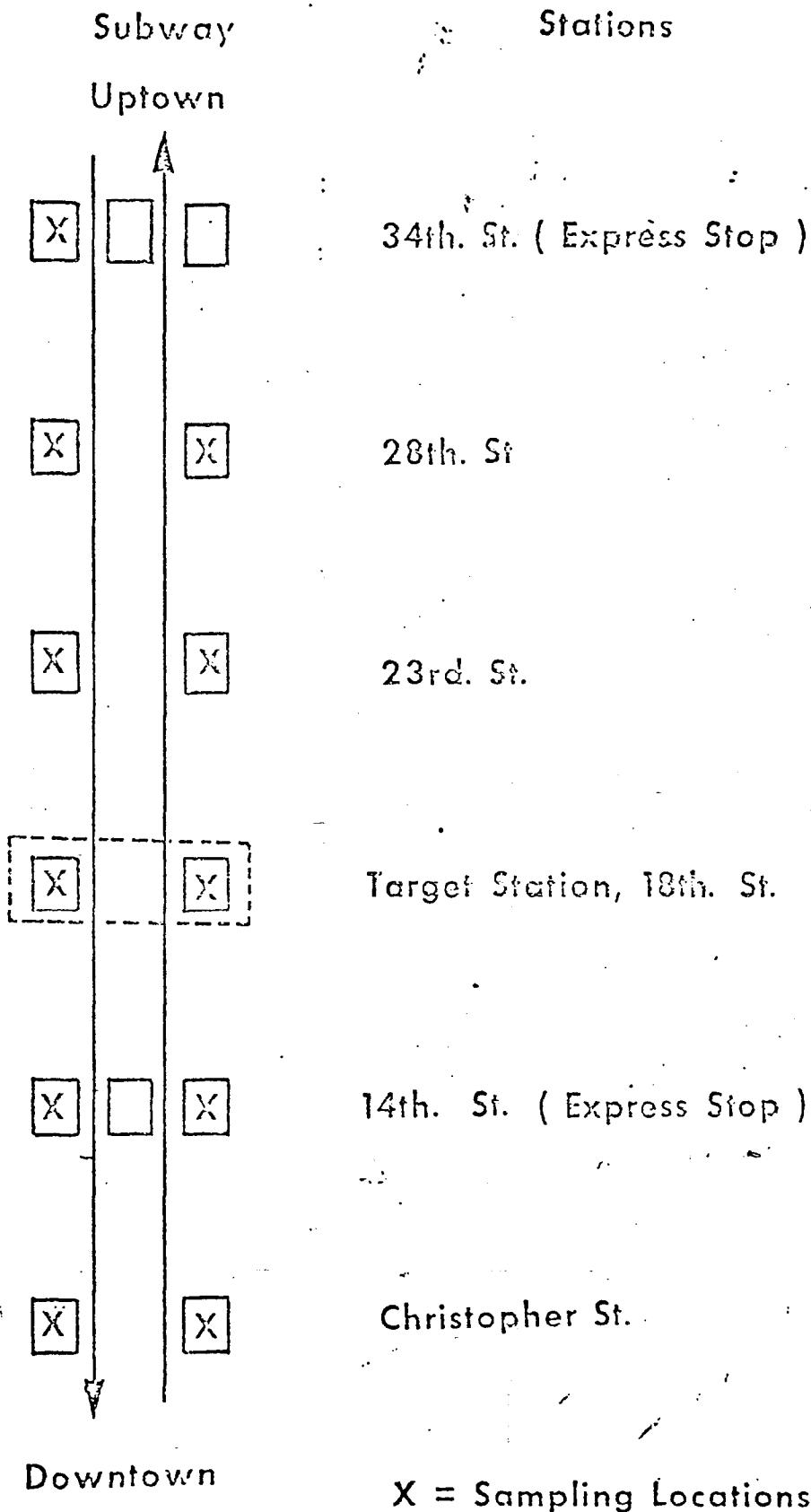


Figure 4. (U) Target Station and Station Sampling Locations on Seventh Avenue Line, Test V. (U)

TABLE 1. (U) SAMPLING SCHEDULE FOR FIXED SAMPLING STATIONS,
TESTS I AND IV (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^{a/}
Bleecker Street Station, Downtown Platform	I-A-1	Control	0 - 10 to 0 - 5 minutes
	I-A-2	Test ^{b/}	0 to 0 + 5 minutes
	I-A-3	Test	0 + 5 to 0 + 10 minutes
	I-A-4	Test	0 + 10 to 0 + 15 minutes
	I-A-5	Test	0 + 15 to 0 + 30 minutes
	I-A-6	Test	0 + 30 to 0 + 45 minutes
	I-A-7	Test	0 + 45 to 0 + 60 minutes
	I-A-8	Test	0 + 75 to 0 + 90 minutes
14th Street Station, Central Platform	I-B-1	Control	0 - 10 to 0 - 5 minutes
	I-B-2	Test	0 to 0 + 5 minutes otherwise operator's schedule is the same as Bleecker Street Station, except for additional control and test sample at 0 + 120 minutes
	I-B-9	Control	0 + 100 to 0 + 105 minutes
	I-B-10	Test	0 + 120 to 0 + 135 minutes
23rd Street Station, Downtown			Bleecker Street Station Schedule
23rd Street Station, Uptown			14th Street Station Schedule
28th Street Station, Downtown			14th Street Station Schedule
28th Street Station, Uptown			Bleecker Street Station Schedule
33rd Street Station, Uptown			14th Street Station Schedule
42nd Street Station, Grand Central, Downtown			Bleecker Street Station Schedule
42nd Street Station, Grand Central, Uptown			14th Street Station Schedule
51st Street Station, Downtown			Bleecker Street Station Schedule
59th Street Station, Downtown			Bleecker Street Station Schedule

a. Station operator will record sampling time for each sample.

b. Sampling to begin at estimated time of agent dissemination.

TABLE 2. (U) SAMPLING SCHEDULE OF TRAIN RIDERS,
TEST I (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^{a/}
Passenger on Express Train, Uptown	II-P-1	Control ^{c/}	On 14th Street
	II-P-2	Test ^{b/}	14th to 59th Street
	II-P-3	Control ^{c/}	On 59th Street
	II-P-4	Test	59th to 14th Street
	II-P-5	Control	On 14th Street
	II-P-6	Test	14th to 59th Street
	II-P-7	Control	On 59th Street
	II-P-8	Test	59th to 14th Street
Passenger on Express Train, Downtown	II-R-1	Control	On 59th Street
	II-R-2	Test	59th to 14th Street
	II-R-3	Control	On 14th Street
	II-R-4	Test	14th to 59th Street
	II-R-5	Control	On 59th Street
	II-R-6	Test	59th to 14th Street
	II-R-7	Control	On 14th Street
	II-R-8	Test	14th to 59th Street
Passenger on Local Train, Uptown	II-S-1	Control	On 14th Street 0 - 10 to 0 - 5 min
	II-S-2	Test	14th to 59th Street
	II-S-3	Control	On 59th Street
	II-S-4	Test	59th to 14th Street
	II-S-5	Control	On 14th Street
	II-S-6	Test	14th to 59th Street
	II-S-7	Control	On 59th Street
	II-S-8	Test	59th to 14th Street
Passenger on Local Train, Downtown	II-T-1	Control	On 59th Street 0 - 10 to 0 - 5 min
	II-T-2	Test	59th to 14th Street
	II-T-3	Control	On 14th Street
	II-T-4	Test	14th to 59th Street
	II-T-5	Control	On 59th Street
	II-T-6	Test	59th to 14th Street
	II-T-7	Control	On 14th Street
	II-T-8	Test	14th to 59th Street
Drop Man (Drops agent between 23rd and 28th Street Stations). - rides last car; drops agent between last car and next to last car, then moves forward in train - leaves at 42nd Street	II-U-1	Control	0 - 15 to 0 - 10 min
	II-U-2	Test	Drop Time to 42nd Street
	II-U-3	Test	42nd Street Station to Street Level

- a. Operator will record sampling time for each sample.
- b. First train departing 14th Street Station after dissemination train.
- c. Local train operators will change samplers and collect control at street level before returning trip.

TABLE 6. ~~TEST~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS RIDING SUBWAY TRAINS, TEST 11^a (U)

Route ^b	Downtown Trains			Uptown Trains		
	Sampling Period, minutes ^c /	Organisms Inhaled Per Minute ^d /	Route ^b	Sampling Period, minutes ^c /	Organisms Inhaled Per Minute ^d /	
Express Train Riders			Express Train Riders			
72nd to 14th Sts.	2 to 10 24 to 33 43 to 51 61 to 70	8,460 3,030 970 680	14th to 72nd Sts.	3 to 12 17 to 25 43 to 52 58 to 67	10,360 8,000 2,730 890	
72nd to 34th Sts.	40 to 51	670	14th to 42nd Sts.	5 to 13	28,550	
34th to 14th Sts.	63 to 70	790	42nd to 72nd Sts.	21 to 27	3,290	
Local Train Riders			Local Train Riders			
59th to 14th Sts.	0 to 12 29 to 38 52 to 61 68 to 76	58,790 5,690 1,160 840	14th to 59th Sts.	6 to 16 23 to 32 52 to 60 71 to 80	73,580 12,330 1,770 1,650	
59th to 34th Sts.	35 to 41	930	14th to 42nd Sts.	7 to 15	53,080	
33rd to 23rd St.	50 to 55	2,350	42nd to 59th Sts.	22 to 26	3,350	
50th to 42nd Sts.	72 to 85	60	23rd to 50th Sts.	63 to 72	3,360	
Operative Samples ^e /						
			18th to 34th Sts.	0 to 3	170	
			34th to Street Level	3 to 6	150	

- a. Seventh Avenue line, Wednesday, 8 June 1966.
- b. Sampler was operated from time of entry into boarding station until exit from destination station.
- c. Air sampling started at 0 minutes; agent package dropped at 0 + 2 minutes.
- d. Calculated on human inhalation rate of 10 liters of air per minute.
- e. Air samples collected by operative after drop of agent package.



TABLE 6. ~~TEST~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS RIDING SUBWAY TRAINS, TEST 11a/ (U)

Route ^{b/}	Downtown Trains			Uptown Trains		
	Sampling Period, minutes ^{c/}	Organisms Inhaled	Per Minute ^{d/}	Sampling Period, minutes ^{c/}	Organisms Inhaled	Per Minute ^{d/}
Express Train Riders			Express Train Riders			
72nd to 14th Sts.	2 to 10 24 to 33 43 to 51 61 to 70	8,460 3,030 970 680		14th to 72nd Sts.	3 to 12 17 to 25 43 to 52 58 to 67	10,360 8,000 2,730 890
72nd to 34th Sts.	40 to 51	670		14th to 42nd Sts.	5 to 13	28,550
34th to 14th Sts.	63 to 70	790		42nd to 72nd Sts.	21 to 27	3,290
Local Train Riders			Local Train Riders			
59th to 14th Sts.	0 to 12 29 to 38 52 to 61 68 to 76	58,790 5,690 1,180 840		14th to 59th Sts.	6 to 16 23 to 32 52 to 60 71 to 80	73,580 12,330 1,770 1,650
59th to 34th Sts.	35 to 41	930		14th to 42nd Sts.	7 to 15	53,080
33rd to 23rd St.	50 to 55	2,350		42nd to 59th Sts.	22 to 26	3,350
50th to 42nd Sts.	72 to 85	60		23rd to 50th Sts.	63 to 72	3,360
Operative Samples ^{e/}						
			18th to 34th Sts.	0 to 3	170	
			34th to Street Level	3 to 6	150	

- a. Seventh Avenue line, Wednesday, 8 June 1966.
- b. Sampler was operated from time of entry into boarding station until exit from destination station.
- c. Air sampling started at 0 minutes; agent package dropped at 0 + 2 minutes.
- d. Calculated on human inhalation rate of 10 liters of air per minute.
- e. Air samples collected by operative after drop of agent package.



TABLE 4. (U) SAMPLING SCHEDULE FOR FIXED SAMPLING STATIONS,
TEST II (U)

Station/Location	No.	Sample Type	Station Sampling Periods ^{a/}
14th Street Station, Central Platform	II-B-1	Control	0 - 10 to 0 - 5 minutes
	II-B-2	Test ^{b/}	0 to 0 + 5 minutes
	II-B-3	Test	0 + 5 to 0 + 10 minutes
	II-B-4	Test	0 + 10 to 0 + 15 minutes
	II-B-5	Test	0 + 15 to 0 + 30 minutes
	II-B-6	Test	0 + 30 to 0 + 45 minutes
	II-B-7	Test	0 + 45 to 0 + 60 minutes
	II-B-8	Test	0 + 75 to 0 + 90 minutes
	II-B-9	Control (on street)	0 + 100 to 0 + 105 minutes
	II-B-10	Test	0 + 120 to 0 + 135 minutes
18th Street Station, Downtown			14th Street Station Schedule for samples B1 thru B8
18th Street Station, Uptown			18th Street Station Schedule
23rd Street Station, Downtown			18th Street Station Schedule
23rd Street Station, Uptown			14th Street Station Schedule
28th Street Station, Downtown			14th Street Station Schedule
28th Street Station, Uptown			18th Street Station Schedule
34th Street Station, Uptown			14th Street Station Schedule
42nd Street Station, Times Square, Train Platform, Downtown			18th Street Station Schedule
42nd Street Station, Times Square, Uptown			14th Street Station Schedule
50th Street Station, Downtown			18th Street Station Schedule
59th Street Station, Uptown, Columbus Circle			14th Street Station Schedule

a. Sampling operator will record sampling time for each sample.
 b. Sampling to begin at estimated time of agent dissemination.

TABLE 3. (U) SAMPLING SCHEDULE OF SIMULATED SUBWAY USERS, TEST I (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^{a/}
Simulated Passenger on Local Train, Uptown	I-V-1	Control	On 14th Street
	I-V-2	Test ^{b/}	0 - 10 to 0 - 5 minutes 14th thru 28th Street
	I-V-3	Control	On 28th Street
	I-V-4	Test	28th thru 59th Street
	I-V-5	Control	On 59th Street
	I-V-6	Test	59th thru 33rd Street
	I-V-7	Control	Control on 33rd Street
	I-V-8	Test	33rd thru 23rd Street
	I-V-9	Control	On 23rd Street
	I-V-10	Test	23rd thru 50th Street
Simulated Passenger on Express Train, Downtown	I-W-1	Control	On 14th Street
	I-W-2	Test	0 - 10 to 0 - 5 minutes 14th thru 42nd Street
	I-W-3	Control	On 42nd Street
	I-W-4	Test	42nd thru 59th Street
	I-W-5	Control	On 59th Street
	I-W-6	Test	59th to 42nd Street
	I-W-7	Control	42nd Street
	I-W-8	Test	42nd thru 14th Street

a. Sampling operator will record sampling time for each sample.

b. Sampling to begin at estimated time of agent dissemination.

TABLE 6. (U) SAMPLING SCHEDULE OF SIMULATED SUBWAY USERS, TEST II (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^{a/}
Simulated Passenger on Local Train, Uptown	II-V-1	Control	On 14th Street
	II-V-2	Test ^{b/}	0 - 10 to 0 - 5 minutes 14th thru 28th Street
	II-V-3	Control	On 28th Street
	II-V-4	Test	28th thru 59th Street
	II-V-5	Control	On 59th Street
	II-V-6	Test	59th thru 33rd Street
	II-V-7	Control	Control on 33rd Street
	II-V-8	Test	33rd thru 23rd Street
	II-V-9	Control	On 23rd Street
	II-V-10	Test	23rd thru 50th Street
Simulated Passenger on Express Train, Downtown	II-W-1	Control	On 14th Street 0 - 10 to 0 - 5 minutes
	II-W-2	Test	14th thru 42nd Street
	II-W-3	Control	On 42nd Street
	II-W-4	Test	42nd thru 59th Street
	II-W-5	Control	On 59th Street
	II-W-6	Test	59th Street to 34th Street
	II-W-7	Control	On 34th Street
	II-W-8	Test	34th thru 14th Street

a. Sampling operator will record sampling time for each sample.

b. Sampling to begin at estimated time of agent dissemination.

TABLE 5. (U) SAMPLING SCHEDULE OF TRAIN SAMPLING OPERATIONS, TEST II (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^{a/}
Express Train Rider, Uptown	I-P-1	Control ^{c/}	On 14th Street
	I-P-2	Test ^{b/}	14th to 59th Street
	I-P-3	Control ^{c/}	On 59th Street
	I-P-4	Test	59th to 14th Street
	I-P-5	Control	On 14th Street
	I-P-6	Test	14th to 59th Street
	I-P-7	Control	On 59th Street
	I-P-8	Test	59th to 14th Street
Express Train Rider, Downtown	I-R-1	Control	On 59th Street
	I-R-2	Test	59th to 14th Street
	I-R-3	Control	On 14th Street
	I-R-4	Test	14th to 59th Street
	I-R-5	Control	On 59th Street
	I-R-6	Test	59th to 14th Street
	I-R-7	Control	On 14th Street
	I-R-8	Test	14th to 59th Street
Local Train Rider, Uptown	I-S-1	Control	On 14th Street
	I-S-2	Test ^{b/}	0 - 10 to 0 - 5 minutes 14th to 59th Street
	I-S-3	Control	On 59th Street
	I-S-4	Test	59th to 14th Street
	I-S-5	Control	On 14th Street
	I-S-6	Test	14th to 59th Street
	I-S-7	Control	On 59th Street
	I-S-8	Test	59th to 14th Street
Local Train Rider, Downtown	I-T-1	Control ^{c/}	On 59th Street
	I-T-2	Test	0 - 10 to 0 - 5 minutes 59th to 14th Street
	I-T-3	Control	On 14th Street
	I-T-4	Test	14th to 59th Street
	I-T-5	Control	On 59th Street
	I-T-6	Test	59th to 14th Street
	I-T-7	Control	On 14th Street
	I-T-8	Test	14th to 59th Street
Drop Man (Drops agent between 23rd and 28th Street Stations) - rides last car; drops agent between last car and next to last car, then moves forward in train - leaves at 42nd Street	I-U-1	Control	0 - 15 to 0 - 10 minutes
	I-U-2	Test	Drop time to 42nd Street
	I-U-3	Test	42nd Street Station to Street Level

a. Operator will record sampling time for each sample.

b. First train departing 14th Street Station after dissemination train.

c. Local and express train operators will change samplers and collect control at street level before return trip.

TABLE 7. (U) SAMPLING SCHEDULE FOR FIXED SAMPLING STATIONS, TEST III (U)

Station/Location	Sample No.	Type	Station Sampling Period ^a /
50th Street Station, ^b Downtown Platform	III-A-1	Control	0 - 15 to 0 - 10 minutes
	III-A-2	Test	0 to 0 + 5 minutes
	III-A-3	Test	0 + 5 to 0 + 10 minutes
	III-A-4	Test	0 + 10 to 0 + 30 minutes
	III-A-5	Test	0 + 30 to 0 + 45 minutes
	III-A-6	Test	0 + 45 to 0 + 60 minutes
	III-A-7	Tcst	0 + 80 to 0 + 90 minutes
42nd Street Station, Downtown			50th St. Station Schedule
42nd Street Station, Uptown			50th St. Station Schedule
34th Street Station, Downtown			50th St. Station Schedule
34th Street Station, Uptown			50th St. Station Schedule
23rd Street Station, Downtown			50th St. Station Schedule
23rd Street Station, Uptown			50th St. Station Schedule
14th Street Station, Downtown			50th St. Station Schedule
4th Street Station, Uptown			50th St. Station Schedule
14th Street Station, Uptown			50th St. Station Schedule
50th Street Station, Uptown			50th St. Station Schedule

a. Sampling operator will record sampling time for each sample.

b. Test sampling to begin at estimated time for agent dissemination.

TABLE 8. (U) SAMPLING SCHEDULE OF TRAIN RIDERS,
TEST III (U)

Station/Location	Sample No.	Type	Station Sampling Period ^{a/}
Express Train Riders, ^{b/} Uptown Express	III-J-1	Control ^{c/}	On 4th Street
	III-J-2	Test	4th to 42nd Street Station
	III-J-3	Control	On 42nd Street
	III-J-4	Test	42nd to 4th Street Station
	III-J-5	Control	On 4th Street
	III-J-6	Test	4th to 42nd Street Station
	III-J-7	Control	On 42nd Street
	III-J-8	Test	42nd to 4th Street Station
Local Train Rider, ^{b/} Uptown	III-K-1	Control	On 4th Street
	III-K-2	Test	4th to 50th Street Station
	III-K-3	Control	On 50th Street
	III-K-4	Test	50th to 4th Street Station
	III-K-5	Control	On 4th Street
	III-K-6	Test	4th to 50th Street Station
	III-K-7	Control	On 50th Street
	III-K-8	Test	50th to 4th Street Station
Local Train Rider, ^{b/} Downtown	III-L-1	Control	On 50th Street
	III-L-2	Test	50th to 4th Street Station
	III-L-3	Control	On 4th Street
	III-L-4	Test	4th to 50th Street Station
	III-L-5	Control	On 50th Street
	III-L-6	Test	50th to 4th Street Station
	III-L-7	Control	On 4th Street
	III-L-8	Test	50th to 4th Street Station

a. Sampling operator will record time for each sample.

b. First train to depart station after start of agent dissemination.

c. Five-minute control samples.

TABLE 9. (U) SAMPLING SCHEDULE OF SIMULATED SUBWAY USERS TEST III (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^{a/}
Simulated Passenger No. 1b/	III-M-1	Control ^{c/}	On 42nd Street
	III-M-2	Test	42nd to 23rd Street
	III-M-3	Control	On 23rd Street
	III-M-4	Test	23rd to 4th Street
	III-M-5	Control	On 4th Street
	III-M-6	Test	4th to 23rd Street
	III-M-7	Control	On 23rd Street
	III-M-8	Test	23rd to 42nd Street
Simulated Passenger No. 2b/ on 28th to 59th Street and Return	III-N-1	Control	On 34th Street
	III-N-2	Test	34th to 23rd Street
	III-N-3	Control	On 23rd Street
	III-N-4	Test	23rd to 14th Street
	III-N-5	Control	On 14th Street
	III-N-6	Test	14th to 23rd Street
	III-N-7	Control	On 23rd Street
	III-N-8	Test	23rd to 34th Street

- a. Sampling operator will record sampling time for each sample.
- b. Sampling to begin at estimated time of agent dissemination.
- c. Five-minute control samples.

TABLE 10. (U) SAMPLING SCHEDULE OF FIXED STATION SAMPLING, TEST V (U)

Station/Location	Sample No.	Sample Type	Station Sampling Periods ^{a/}
28th Street Station ^{b/} Downtown	V-A-1	Control	0 -- 15 to 0 - 10 minutes
	V-A-2	Test	0 to 0 + 5 minutes
	V-A-3	Test	0 + 5 to 0 + 15 minutes
	V-A-4	Test	0 + 15 to 0 + 30 minutes
	V-A-5	Test	0 + 30 to 0 + 45 minutes
	V-A-6	Test	0 + 45 to 0 + 60 minutes
	V-A-7	Test	0 + 80 to 0 + 90 minutes
28th Street Station - Uptown Side			28th Street Station Schedule
23rd Street Station - Downtown Side			28th Street Station Schedule
23rd Street Station - Uptown Side			28th Street Station Schedule
18th Street Station - Downtown Side			28th Street Station Schedule
18th Street Station - Uptown Side			28th Street Station Schedule
14th Street Station - Downtown Side			28th Street Station Schedule
14th Street Station - Uptown Side			28th Street Station Schedule
Christopher Street Station - Uptown Side			28th Street Station Schedule
Christopher Street Station - Downtown Side			28th Street Station Schedule
34th Street Station - Downtown Side			28th Street Station Schedule

a. Station operator will record sampling time for each sample.

b. Sampling to begin at estimated time of agent dissemination.

TABLE 11. (U) SAMPLING SCHEDULE OF TRAIN RIDERS,
TEST V (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^a /
Express Train Rider ^b / Downtown Express	V-I-1	Control ^c /	On 34th Street
	V-I-2	Test	34th to 14th Street Station
	V-I-3	Control	On 14th Street
	V-I-4	Test	14th to 34th Street Station
	V-I-5	Control	On 34th Street
	V-I-6	Test	34th to 14th Street Station
	V-I-7	Control	On 14th Street
	V-I-8	Test	14th to 34th Street Station
Local Train Rider Downtown Train	V-J-1	Control	On 34th Street
	V-J-2	Test	34th to Christopher Street Station
	V-J-3	Control	On Christopher Street
	V-J-4	Test	Christopher to 34th Street Station
	V-J-5	Control	On 34th Street
	V-J-6	Test	34th to Christopher Street Station
	V-J-7	Control	On Christopher Street
	V-J-8	Test	Christopher to 34th Street Station
Local Train Rider Uptown Train	V-K-1	Control	On Christopher Street
	V-K-2	Test	Christopher to 34th Street Station
	V-K-3	Control	On 34th Street
	V-K-4	Test	34th to Christopher Street Station
	V-K-5	Control	On Christopher Street
	V-K-6	Test	Christopher to 34th Street Station
	V-K-7	Control	On 34th Street
	V-K-8	Test	34th to Christopher Street Station

a. Operator will record sampling time for each sample.

b. First train to depart station after start of agent dissemination.

c. Five-minute control samples.

TABLE 12. (U) SAMPLING SCHEDULE OF SIMULATED SUBWAY USERS TEST V (U)

Station/Location	Sample No.	Type	Station Sampling Periods ^{a/}
Simulated Passenger No. 1 ^{b/}	V-L-1	Control ^{c/}	On 28th Street
	V-L-2	Test	28th to 18th Street Station
	V-L-3	Control	On 18th Street
	V-L-4	Test	18th to 23rd Street Station
	V-L-5	Control	On 23rd Street
	V-L-6	Test	23rd to 14th Street Station
	V-L-7	Control	On 14th Street
	V-L-8	Test	14th to 18th Street Station
Simulated Passenger No. 2 ^{b/}	V-M-1	Control	On 18th Street
	V-M-2	Test	18th to 28th Street Station
	V-M-3	Control	On 28th Street
	V-M-4	Test	28th to 18th Street Station
	V-M-5	Control	On 18th Street
	V-M-6	Test	18th to Christopher Street Station
	V-M-7	Control	On Christopher Street
	V-M-8	Test	Christopher to 18th Street Station

a. Sampling operator will record sampling time for each sample.

b. Sampling to begin at estimated time of agent dissemination.

c. Five minute control samples.

APPENDIX B

(U) TRAIN REGISTERSTABLES

1. Train Register, Test I	50
2. Train Register, Test II	51
3. Train Register, Test III	52
4. Train Register, Test IV	53
5. Train Register, Test V	54

TABLE 1. (U) TRAIN REGISTER, TEST I^{a/} (U)

Arrival Time	Downtown Platform				Uptown Platform			
	Local Trains		Express Trains		Local Trains		Express Trains	
	L No.	First Car/ Last Car	Arrival Time	E No.	First Car/ Last Car	Arrival Time	L No.	First Car/ Last Car
0926	1	9232/7814	0927	1	7930/9062	0913	30	9118/9284
0930	2b/	9136/7878	0930	2	8694/8830	0915	31	7886/9202
0932	3b/	7834/9140	0934	3	8954/8782	0916	32	7906/7846
0939	4b/	9226/9172	0937	4	8758/8750	0918	33	9076/7802
0946	5b/	7808/9082	0940	5	7300/8788	0920	34	7874/9088
0948	6b/	9084/7848	0946	6	8866/7750	0922	35	9244/9138
0955	7b/	9266/7870	0954	7	9036/9038	0924	36	9248/7850
0958	8b/	7890/7854	0956	8	9022/8876	0925	37	7902/9246
1003	9b/	7816/9274	1000	9	8936/8746	0927	38	9168/9250
1008	10b/	9126/7842	1006	10	8802/7924	0930	39	9288/9294
1013	11b/	9102/9270	1011	11	8708/8956	0933	40	7864/9278
1016	12b/	9298/9078	1018	12	8764/8960	0937	41a/	9130/9224
1025	13	7826/9086	1022	13	7770/8728	0944	42	9232/7814
1031	14	7862/7872	1026	14	8844/8713	0947	43(2)d/	9136/7878
1034	15	9170/9242	1035	15	8852/8906	0952	44(3)d/	7834/9140
1037	16	9162/9190	1037	16	8920/8822	0958	45(4)d/	9226/9172
1044	17	9212/9142	1042	17	9018/9064	1002	46(5)d,e/	7808/9082
1050	18	7805/9076	1048	18	8938/8760	1007	47(6)d/	9084/7848
1055	19	9176/9252	1055	19	7736/8786	1013	48(7)	9266/7870
1100	20	9246/7902	1100	20(38)	7916/8656	1017	49(8)	7890/7854
1103	21	9202/7886	1104	21(41)	8848/8740	1022	50(9)	7816/9274
1107	22(41)	9224/9180	1107	22(44)	9072/8804	1027	51(10)	9126/7842
1113	23	9250/9168	1115	23(39)	7737/8868	1032	52(11)	9102/9270
1120	24(2)	7876/9136	1117	24	8922/8842	1037	53	9050/8952
1124	25	- /7864	1121	25(45)	8756/8688	1040	54(12)	9298/2078
1128	26(4)	9172/9226	1125	26(48)	8744/8916			
1134	27(3)	9140/7834	1132	27(47)	8812/9002			
1142	28(6)	7848/9084	1138	28(50)	7669/8834			
1144	29(5)	9082/7808	1141	29(49)	8990/8826			
			1147	30	7743/8749			

a. 14th St. Station, Lexington Avenue Line, 7 June 1966, Time Zero = 0930 hours.

b. Local train which returned to station later in observation period as local traveling in opposite direction.

c. Express trains which returned to station later in period as express in opposite direction.

d. Local trains which returned to station a third time as locals in opposite direction.

e. Second passage train in which air sample was collected.

TABLE 2. (U) TRAIN REGISTER, TEST III^a / (U)

Arrival Time	Downtown Platform				Uptown Platform				Express Trains	
	Local Trains		Arrival Time	Express Trains	Local Trains		Arrival Time	Express Trains	First Car/Last Car	
	L No.	First Car/Last Car		E No.	First Car/Last Car		L No.	First Car/Last Car		
0930	1b/	7184/7373	0931	1c/	7143/6615	0929	18	7246/7280	0931	20
0931	2b/	6707/7312	0936	2c/	7504/5753	0930	19	7319/7361	0935	21c/
0936	3b/	7281/7412	0940	3c/	7445/7910	0934	20	7253/7364	0940	22
0941	4b/	8632/7241	0943	4c/	5940/7554	0935	21	7176/7197	0944	23c/
0948	5b/	7446/7399	0948	5c/	6595/6552	0937	22	7247/7192	0946	24
1003	6	5773/ -	0950	6	7229/ -	0939	23	7220/7193	0950	25
1006	7b/	6746/7318	1002	7	6724/9630	0941	24	8594/7192	0953	26
1010	8b/	6701/7214	1005	8	7473/5744	0942	25	7391/7363	0959	27
1014	9b/	6700/7390	1009	9	7558/7686	0945	25	7310/7221	1001	28
1019	10b/	7369/6728	1017	10	5748/ -	0946	27	7514/6725	1006	29
1025	11b/	7254/8660	1022	11	7505/5734	0952	28(1)d/	7184/7373	1010	30
1031	12	6748/6833	1027	12(21)	5858/5821	0955	29(2)	6707/7312	1015	31
1037	13b/	7223/8663	1033	13	7426/7436	1000	30(3)	7281/7412	1018	32
1043	14b/	7363/7391	1035	14(23)	5950/7020	1008	31(4)	8632/7241	1026	33
1046	15	7291/7285	1041	15	5776/ -	1012	32(5)	7444/7399	1031	34
1053	16b/	7312/6707	1045	16	6225/7932	1015	33	7229/7249	1039	35
1056	17b/	7286/8677	1050	17	7508/7425	1021	34	6711/7440	1041	36
			1054	18	7918/5964	1029	35	6724/8630	1046	37
			1059	19	6515/7125	1032	36(7)	6746/7318	1055	38(1)
						1036	37(8)	6701/7214	1059	39(2)
						1041	38(9)	6700/7390	1103	40(4)
						1045	39(10)	7369/6728	1105	41(3)
						1050	40(11)	7254/8660	1108	42
						1057	41	7251/8653	1112	43
						1102	42(13)	7223/8663	1119	44(5)
						1106	43(14)	7101/7391		
						1116	44(16)	7312/6707		
						1123	45(17)	7286/8677		

a. 14th St. Station, 7th Avenue Line, 8 June 1966, Time Zero = 0930 hours.

b. Local train which returned to station later in observation period as local traveling in opposite direction.

c. Express trains which returned to station later in period as express in opposite direction.

d. Second passage train in which air sample was collected.

TABLE 3. (U) TRAIN REGISTER, TEST III^{a/} (U)

Arrival Time	Downtown Platform					Uptown Platform				
	Local Trains		Arrival Time	Express Trains	First Car/Last Car	Local Trains		Arrival Time	Express Trains	First Car/Last Car
	L No.	First Car/Last Car				E No.	First Car/Last Car			
0901	1	1033/1393	0900	1	1491/518	0902	27	992/1366	0900	24 ^{e/}
0907	2	1137/211	0901	2	1307/1327	0904	28	1334/1326	0903	25
0911	3 ^{b/}	828/996	0904	3	626/1519	0908	29	199/1330	0905	26
0918	4 ^{b/}	279/944	0905	4	3054/3042	0913	30	1323/1033	0906	27
0921	5 ^{b/}	703/1725	0906	5	1670/1655	0919	31	580/1058	0907	28 ^{e/}
0922	6 ^{b/}	1242/1306	0908	6	3022/3261	0925	32	211/1137	0915	29
0924	7 ^{b/}	1510/631	0910	7	3203/3209	0927	33	612/1740	0917	30 ^{e/}
0927	8 ^{b/}	508/414	0911	8	1265/357	0929	34(3)	996/828	0918	31
0931	9 ^{b/}	1464/1482	0912	9	3187/3347	0931	35	1681/696	0920	32
0932	10 ^{b/}	788/792	0915	10	1794/415	0934	36(4)	944/279	0923	33
0934	11 ^{b/}	903/437	0917	11	1699/672	0935	37(5)	1725/703	0925	34
0936	12 ^{b/}	1017/1471	0918	12	1803/1826	0939	38(6)	1426/1242	0926	35
0942	13 ^{b/}	1297/1494	0920	13	3196/3330	0940	39(7)	631/1510	0933	36
0944	14 ^{b/}	1244/1232	0922	14	3234/3342	0945	40(8)	414/508	0937	37
0946	15 ^{b/}	131/1765	0930	15	3246/3319	0949	41(9) ^{d/}	1482/1464	0942	38
0952	16 ^{b/}	1451/1015	0935	16	1367/1810	0950	42(10)	792/788	0945	39
0955	17 ^{b/}	1754/364	0937	17	3029/3118	0955	43(11)	437/903	0958	40
1000	18 ^{b/}	1158/270	0945	18	3136/3207	0957	44(12)	1471/1017	1007	41
1002	19 ^{b/}	1637/731	0955	19	3298/3322	0958	45(13)	1494/1297	1013	42
1008	20 ^{b/}	1049/969	1000	20(24)	1807/3134	1002	46(14)	1232/1244	1023	43
1012	21 ^{b/}	753/473	1012	21(28)	3299/3300	1005	47(15) ^{d/}	1765/131	1025	44
1020	22	1219/859	1020	22(30)	3262/3210	1008	48(16)	1015/1451	1030	45
1021	23	598/535	1027	23	3301/3278	1013	49(17)	364/1754		
1025	24	284/1136				1017	50(18)	270/1158		
1027	25	1617/771				1020	51(19)	731/1637		
1032	26	1273/1293				1024	52(20)	969/1049		
						1028	53(21)	473/753		

a. 14th St. Station; 8th Avenue Line, 9 June 1966, Time Zero = 0900 hours.

b. Local train which returned to station later in observation period as local traveling in opposite direction.

c. Express trains which returned to station later in period as express in opposite direction.

d. Second passage train in which air sample was collected.

TABLE 4. (U) TRAIN REGISTER, TEST IV₂ (U)

Arrival	Locality		Locality		Locality		Locality		Locality		Locality	
	Arrival	Locality	Arrival	Locality	Arrival	Locality	Arrival	Locality	Arrival	Locality	Arrival	Locality
1317	1	9099/9150	1316	8834/7940	1	8834/7940	1302	39	9139/9220	1304	41	7935/9342
1328	2	9239/9288	1322	7816/7800	3	8933/9065	1307	40	9244/9118	1307	42	3912/3956
1323	3	9239/9288	1326	7816/7800	4	8934/9361	1313	41	7842/9126	1315	43	9032/9056
1340	4	7072/7922	1336	1331	4	8738/7736	1317	42	9149/9110	1318	44	9012/ -
1334	45	9239/7824	1320	5	8822/8978	1321	47	9244/9126	1323	45	9026/ -	
1350	46	9296/784	1322	6	9018/9064	1327	44	9094/7848	1328	46	8890/7743	
1343	47	9296/784	1321	5	8822/8978	1320	45	9095/9265	1333	47	8700/7758	
1410	48	7886/7822	1403	11	8934/8776	1347	48	1315/7740	1348	50	8642/8216	
1416	49	7836/9076	1413	12	9036/9096	1416	49	49(4) d	1352	51	8996/7734	
1419	50	9174/7946	1416	13	8835/8874	1420	50(5) d	7672/7852	1357	52	7404/8234	
1424	51	7354/9274	1424	14	8934/7950	1425	51(6) d	9236/7994	1403	53	9056/8932	
1427	52	7902/7822	1426	15	8936/9030	1402	52(7) d	7268/7382	1409	54	8834/8754	
1444	53	9220/9138	1421	16	8933/8912	1417	54(3) d	7902/9208	1419	55	8978/7832	
1445	54	9176/9244	1420	17	7933/8912	1417	55(4) d	9149/9012	1421	56	9054/9118	
1457	55	9150/9084	1455	21	7743/8940	1432	57(12)	7806/9076	1434	59	9074/7928	
1459	56	9150/9084	1456	22	7743/8940	1442	59(14)	7654/9274	1443	61	7770/8728	
1506	57	9214/9102	1506	24	8656/8830	1442	60(48)	9033/8970	1448	60	8766/9022	
1507	58	9214/9102	1510	25	25(50)	1506	60(50)	8934/7540	1514	61	8950/8754	
1509	59	9150/9084	1503	26	7625/7592	1514	62	7824/9270	1524	62	1522	
1513	60	9256/9036	1514	63	7882/7868	1530	63(54)	8964/8854	1532	64	1532	
1516	61	9256/9036	1516	64	8964/8854	1530	64(55)	9216/9208	1534	65	1534	
1519	62	9256/9036	1517	65	8964/8854	1530	65(56)	9216/9208	1535	66	1535	
1522	63	9256/9036	1518	66	8964/8854	1530	66(57)	9216/9208	1536	67	1536	
1525	64	9256/9036	1519	67	8964/8854	1530	67(58)	9216/9208	1537	68	1537	
1528	65	9256/9036	1520	68	8964/8854	1530	68(59)	9216/9208	1538	69	1538	
1531	66	9256/9036	1521	69	8964/8854	1530	69(60)	9216/9208	1539	70	1539	
1534	67	9256/9036	1522	70	8964/8854	1530	70(61)	9216/9208	1540	71	1540	
1537	68	9090/9218	1544	71	8736/9069	1530	71(62)	8754/8930	1543	72	1543	
1539	69	9090/9218	1545	72	8736/9069	1530	72(63)	8754/8930	1544	73	1544	
1542	70	9090/9218	1546	73	8736/9069	1530	73(64)	8754/8930	1545	74	1545	
1545	71	9090/9218	1547	74	8736/9069	1530	74(65)	8754/8930	1546	75	1546	
1548	72	9090/9218	1548	75	8736/9069	1530	75(66)	8754/8930	1547	76	1547	
1551	73	9090/9218	1549	76	8736/9069	1530	76(67)	8754/8930	1548	77	1548	
1553	74	9090/9218	1550	77	8736/9069	1530	77(68)	8754/8930	1549	78	1549	
1556	75	9090/9218	1551	78	8736/9069	1530	78(69)	8754/8930	1550	79	1550	
1559	76	9090/9218	1552	79	8736/9069	1530	79(70)	8754/8930	1551	80	1551	
1562	77	9090/9218	1553	80	8736/9069	1530	80(71)	8754/8930	1552	81	1552	
1565	78	9090/9218	1554	81	8736/9069	1530	81(72)	8754/8930	1553	82	1553	
1568	79	9090/9218	1555	82	8736/9069	1530	82(73)	8754/8930	1554	83	1554	
1571	80	9090/9218	1556	83	8736/9069	1530	83(74)	8754/8930	1555	84	1555	
1574	81	9090/9218	1557	84	8736/9069	1530	84(75)	8754/8930	1556	85	1556	
1577	82	9090/9218	1558	85	8736/9069	1530	85(76)	8754/8930	1557	86	1557	
1580	83	9090/9218	1559	86	8736/9069	1530	86(77)	8754/8930	1558	87	1558	
1583	84	9090/9218	1560	87	8736/9069	1530	87(78)	8754/8930	1559	88	1559	
1586	85	9090/9218	1561	88	8736/9069	1530	88(79)	8754/8930	1560	89	1560	
1589	86	9090/9218	1562	89	8736/9069	1530	89(80)	8754/8930	1561	90	1561	
1592	87	9090/9218	1563	90	8736/9069	1530	90(81)	8754/8930	1562	91	1562	
1595	88	9090/9218	1564	91	8736/9069	1530	91(82)	8754/8930	1563	92	1563	
1598	89	9090/9218	1565	92	8736/9069	1530	92(83)	8754/8930	1564	93	1564	
1601	90	9090/9218	1566	93	8736/9069	1530	93(84)	8754/8930	1565	94	1565	
1604	91	9090/9218	1567	94	8736/9069	1530	94(85)	8754/8930	1566	95	1566	
1607	92	9090/9218	1568	95	8736/9069	1530	95(86)	8754/8930	1567	96	1567	
1610	93	9090/9218	1569	96	8736/9069	1530	96(87)	8754/8930	1568	97	1568	
1613	94	9090/9218	1570	97	8736/9069	1530	97(88)	8754/8930	1569	98	1569	
1616	95	9090/9218	1571	98	8736/9069	1530	98(89)	8754/8930	1570	99	1570	
1619	96	9090/9218	1572	99	8736/9069	1530	99(90)	8754/8930	1571	100	1571	
1622	97	9090/9218	1573	100	8736/9069	1530	100(91)	8754/8930	1572	101	1572	
1625	98	9090/9218	1574	101	8736/9069	1530	101(92)	8754/8930	1573	102	1573	
1628	99	9090/9218	1575	102	8736/9069	1530	102(93)	8754/8930	1574	103	1574	
1631	100	9090/9218	1576	103	8736/9069	1530	103(94)	8754/8930	1575	104	1575	
1634	101	9090/9218	1577	104	8736/9069	1530	104(95)	8754/8930	1576	105	1576	
1637	102	9090/9218	1578	105	8736/9069	1530	105(96)	8754/8930	1577	106	1577	
1640	103	9090/9218	1579	106	8736/9069	1530	106(97)	8754/8930	1578	107	1578	
1643	104	9090/9218	1580	107	8736/9069	1530	107(98)	8754/8930	1579	108	1579	
1646	105	9090/9218	1581	108	8736/9069	1530	108(99)	8754/8930	1580	109	1580	
1649	106	9090/9218	1582	109	8736/9069	1530	109(100)	8754/8930	1581	110	1581	
1652	107	9090/9218	1583	110	8736/9069	1530	110(101)	8754/8930	1582	111	1582	
1655	108	9090/9218	1584	111	8736/9069	1530	111(102)	8754/8930	1583	112	1583	
1658	109	9090/9218	1585	112	8736/9069	1530	112(103)	8754/8930	1584	113	1584	
1661	110	9090/9218	1586	113	8736/9069	1530	113(104)	8754/8930	1585	114	1585	
1664	111	9090/9218	1587	114	8736/9069	1530	114(105)	8754/8930	1586	115	1586	
1667	112	9090/9218	1588	115	8736/9069	1530	115(106)	8754/8930	1587	116	1587	
1670	113	9090/9218	1589	116	8736/9069	1530	116(107)	8754/8930	1588	117	1588	
1673	114	9090/9218	1590	117	8736/9069	1530	117(108)	8754/8930	1589	118	1589	
1676	115	9090/9218	1591	118	8736/9069	1530	118(109)	8754/8930	1590	119	1590	
1679	116	9090/9218	1592	119	8736/9069	1530	119(110)	8754/8930	1591	120	1591	
1682	117	9090/9218	1593	120	8736/9069	1530	120(111)	8754/8930	1592	121	1592	
1685	118	9090/9218	1594	121	8736/9069	1530	121(112)	8754/8930	1593	122	1593	
1688	119	9090/9218	1595	122	8736/9069	1530	122(113)	8754/8930	1594	123	1594	
1691	120	9090/9218	1596	123	8736/9069	1530	123(114)	8754/8930	1595	124	1595	
1694	121	9090/9218	1597	124	8736/9069	1530	124(115)	8754/8930	1596	125	1596	
1697	122	9090/9218	1598	125	8736/9069	1530	125(116)	8754/8930	1597	126	1597	
1700	123	9090/9218	1599	126	8736/9069	1530	126(117)	8754/8930	1598	127	1598	
1703	124	9090/9218	1600	127	8736/9069	1530	127(118)	8754/8930	1599	128	1599	

TABLE 5. (U) TRAIN REGISTER, TEST V₃ / (U)

Local government which succeeded to maintain later in its administration period a local traveleering opposition to its policies.

d. Second passage to *raja* in which all sample was collected.

Deputy Captain within reasonable time to locate us, to ascertain what has happened to us, and to give us instructions.

Expreess credit lines which refeurned to satation later in a period of

d. Second passage to a la which at sample was collected.

APPENDIX C

TEST RESULTS

TABLES

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TABLE 1. ~~TEST~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS IN SUBWAY STATIONS, TEST I^{a/} (U)

Subway Station Platform	Sampling Period, minutes ^{c/}	Bleecker St.	Organisms Inhaled Per Minute ^{b/} at Indicated Subway Stations					
			14th St.	23rd St.	28th St.	33rd St.	42nd St.	51st St.
U	0 to 5			3,270	1,120	220	15,130	
P	5 to 10			6,820	441,380	13,390	290	
T	10 to 15			15,620	572,410	28,820	15,150	
O								
W	15 to 30			6,080	16,550	25,490	12,310	
N	30 to 45			1,490	43,450	12,750	4,330	
	45 to 60			320	20,690	3,980	3,410	
	75 to 90			1,190	9,200	2,060	1,230	
	120 to 135			760		1,760	450	
D	0 to 5	80	2,290	4,330	50,150		170	190
O	5 to 10	90	5,440	40,770	190,230		510	60
W	10 to 15	390	10,420	11,230	174,140		4,000	330
N								5,100
T	15 to 30	330	7,410	12,740	112,070		3,560	410
O	30 to 45	510	4,840	7,460	29,130		3,970	190
W	45 to 60	1,956	2,480	2,370	13,720		2,080	380
N								1,030
	75 to 90	3,300	960	760	5,130		1,380	100
	120 to 135		530		2,020			1,700

a. Lexington Avenue line, Tuesday, 7 June 1966.

b. Calculated on human inhalation rate of 10 liters of air per minute.

c. Air sampling started at 0 minutes; package containing B. subtilis dropped on uptown train roadbed between 23rd and 28th Street Stations at 0 + 2 minutes.

TABLE 2. CALCULATED RESPIRATORY EXPOSURES,
PERSONS RIDING SUBWAY TRAINS, TEST 1^{a/} (U)

Downtown Trains			Uptown Trains		
Route ^{b/}	Sampling Period, minutes ^{c/}	Organisms Inhaled Per Minute ^{d/}	Route ^{b/}	Sampling Period, minutes ^{c/}	Organisms Inhaled Per Minute ^{d/}
Express Train Riders			Express Train Riders		
59th to 14th Sts.	1 to 9	75,350	14th to 59th Sts.	2 to 10	42,490
	25 to 32	4,980		20 to 29	5,130
	50 to 57	3,830		49 to 56	4,650
	67 to 74	3,630		70 to 77	1,530
59th to 42nd Sts.	43 to 60	580	14th to 42nd Sts.	8 to 12	23,800
42nd to 14th Sts.	70 to 74	3,580	42nd to 59th Sts.	21 to 28	14,920
Local Train Riders			Local Train Riders		
59th to 14th Sts.	6 to 16	33,180	14th to 59th Sts.	4 to 12	136,360
	24 to 33	12,800		32 to 42	17,950
	59 to 68	2,600		48 to 56	4,740
	70 to 80	1,970		82 to 90	1,710
59th to 33rd St.	39 to 44	2,760	14th to 28th Sts.	6 to 10	37,500
51st to 23rd Sts.	67 to 77	1,230	28th to 59th Sts.	20 to 27	55,440
			33rd to 51st Sts.	51 to 56	2,840
Operative Samples ^{e/}					
	23rd to 42nd Sts.		23rd to 42nd Sts.	3 to 6	0
	42nd to Street Level		42nd to Street Level	6 to 8	0

- a. Lexington Avenue line, Tuesday, 7 June 1966.
- b. Sampler was operated from time of entry into boarding station until exit from destination station.
- c. Air sampling started at 0 minutes; agent package dropped at 0 + 2 minutes.
- d. Calculated on human inhalation rate of 10 liters of air per minute.
- e. Air samples collected by operative after drop of agent package.

TABLE 3. (C) CALCULATED RESPIRATORY EXPOSURES,
PERSONS IN SUBWAY STATIONS, TEST IV^a (U)

Subway Station Platform	Sampling Period, minutes ^c /	Organisms Inhaled Per Minute ^b at Indicated Subway Stations					
		Bleecker St.	14th St.	23rd St.	28th St.	33rd St.	42nd St.
U	0 to 5			360	370	30	430
P	5 to 10			7,330	154,640	5,690	210
T	10 to 15			59,660	154,480	3,000	7,640
O							
W	15 to 30			106,890	128,000	35,190	9,640
N	30 to 45			19,240	49,410	7,336	9,570
	45 to 60			15,690	31,540	4,470	4,190
	75 to 90			1,490	13,680	2,240	1,170
	120 to 135			2,260		1,110	1,210
D	0 to 5	10	2,590	1,450	570	80	0
O	5 to 10	110	29,060	95,510	49,860	0	50
W	10 to 15	260	32,690	277,570	86,890	390	30
N							
T	15 to 30	730	25,630	123,830	94,940	4,930	460
O	30 to 45	40	1,370	51,310	40,346	4,270	610
W	45 to 60	660	8,770	27,130	23,580	3,440	190
N	75 to 90	1,150	4,060	4,370	3,710	1,040	80
	120 to 135		2,590		2,880		1,920

a. Lexington Avenue line, Thursday, 9 June 1965.

b. Calculated on human inhalation rate of 10 liters of air per minute.

c. Air sampling started at 0 minutes; package containing B. subtilis dropped on uptown train roadbed between 23rd and 28th Street Stations at 0 + 3 minutes.

TABLE 4. ~~TEST~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS RIDING SUBWAY TRAINS, TEST IV^a / (U)

Downtown Trains			Uptown Trains		
Route ^b	Sampling Period, minutes ^c /	Organisms Inhaled Per Minute ^d /	Route ^b	Sampling Period, minutes ^c /	Organisms Inhaled Per Minute ^d /
Express Train Riders			Express Train Riders		
59th to 14th Sts.	0 to 7 20 to 27 34 to 42 60 to 67	18,580 20,710 7,310 1,170	14th to 59th Sts.	4 to 11 18 to 25 38 to 46 50 to 62	66,070 44,380 6,520 4,950
59th to 42nd Sts.	40 to 49	2,380	14th to 42nd Sts.	0 to 10	16,090
42nd to 14th Sts.	57 to 66	470	42nd to 59th Sts.	22 to 28	16,700
Local Train Riders			Local Train Riders		
59th to 14th Sts.	0 to 5 27 to 35 35 to 44 67 to 76	110,080 27,400 9,070 46,660	14th to 59th Sts.	8 to 16 17 to 27 47 to 55 56 to 66	105,070 50,160 10,600 5,650
59th to 33rd Sts.	49 to 55	2,100	14th to 28th Sts.	12 to 17	55,300
33rd to 23rd Sts.	62 to 69	2,150	28th to 59th Sts.	24 to 34	21,750
			23rd to 51st Sts.	82 to 92	1,650
Operative Samples ^e /					
	23rd to 42nd Sts.	0 to 2 ^f /			310
	42nd to Street Level	2 to 5			770

- a. Lexington Avenue line, Thursday, 9 June 1966.
- b. Sampler was operated from time of entry into boarding station until exit from destination station.
- c. Air sampling started at 0 minutes; agent package dropped at 0 + 3 minutes.
- d. Calculated on human inhalation rate of 10 liters of air per minute.
- e. Air samples collected by operative after drop of agent package.
- f. Control sample count was 1630.

TABLE 5 ~~TEST II~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS IN SUBWAY STATIONS, TEST II^a / (U)

Subway Station Platform	Sampling Period; minutes ^c /	Organisms Inhaled Per Minute ^b / at Indicated Subway Stations					
		14th St.	18th St.	23rd St.	28th St.	34th St.	42nd St.
U	0 to 5		170	179,350	9,850	0	0
P	5 to 10		5,600	900,000	42,280	1,690	1,730
T	10 to 15		13,170	275,000	39,660	6,360	2,930
O							
W	15 to 30		5,290	63,770	13,790	6,300	27,690
N	30 to 45		2,440	25,110	4,590	1,390	760
	45 to 60		1,810	12,330	1,350	300	400
	75 to 90		1,790	7,330	440	40	90
	120 to 135			10,330		140	100
D	0 to 5	0	0	3,700	9,290	0	0
O	5 to 10	4,530	64,670	851,000	25,550	1,250	0
W	10 to 15	7,170	64,670	513,000	44,060	1,030	0
N							5,200
T	15 to 30	NS ^d /	23,000	122,530	25,500	2,010	0
O	30 to 45	NS	5,840	22,530	5,370	380	0
W	45 to 60	470	3,540	9,790	1,350	180	0
N	75 to 90	380	2,420	434	370	110	110
	120 to 135	170			250		NS 240

a. Seventh Avenue line, Wednesday, 8 June 1966.

b. Calculated on human inhalation rate of 10 liters of air per minute.

c. Air sampling started at 0 minutes; package containing B. subtilis dropped on uptown train roadbed between 18th and 23rd Street Stations at 0 + 2 minutes.

d. No sample, pump failure.

TABLE 6. ~~TEST~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS RIDING SUBWAY TRAINS, TEST 11^a (U)

Downtown Trains			Uptown Trains		
Route ^b	Sampling Period, minutes ^c	Organisms Inhaled Per Minute ^d	Route ^b	Sampling Period, minutes ^c	Organisms Inhaled Per Minute ^d
Express Train Riders			Express Train Riders		
72nd to 14th Sts.	2 to 10 24 to 33 43 to 51 61 to 70	8,460 3,030 970 680	14th to 72nd Sts.	3 to 12 17 to 25 43 to 52 58 to 67	10,360 8,000 2,730 890
72nd to 34th Sts.	40 to 51	670	14th to 42nd Sts.	5 to 13	28,550
34th to 14th Sts.	63 to 70	790	42nd to 72nd Sts.	21 to 27	3,290
Local Train Riders			Local Train Riders		
59th to 14th Sts.	0 to 12 29 to 38 52 to 61 68 to 76	58,790 5,690 1,180 840	14th to 59th Sts.	6 to 16 23 to 32 52 to 60 71 to 80	73,580 12,330 1,770 1,650
59th to 34th Sts.	35 to 41	930	14th to 42nd Sts.	7 to 15	53,080
33rd to 23rd St.	50 to 55	2,350	42nd to 59th Sts.	22 to 26	3,350
50th to 42nd Sts.	72 to 85	60	23rd to 50th Sts.	63 to 72	3,360
Operative Samples ^e					
	18th to 34th Sts.	0 to 3	18th to 34th Sts.	0 to 3	170
	34th to Street Level	3 to 6	34th to Street Level	3 to 6	150

- a. Seventh Avenue line, Wednesday, 8 June 1966.
- b. Sampler was operated from time of entry into boarding station until exit from destination station.
- c. Air sampling started at 0 minutes; agent package dropped at 0 + 2 minutes.
- d. Calculated on human inhalation rate of 10 liters of air per minute.
- e. Air samples collected by operative after drop of agent package.

TABLE 7 CALCULATED RESPIRATORY EXPOSURES,
PERSONS IN SUBWAY STATIONS, TEST III^{a/} (U)

Station	Sampling Period, minutes, ^{b/}	Organisms Inhaled Per Minute ^{c/}	
		Downtown Platform	Uptown Platform
4th St.	0 to 5		0
	5 to 10		
	10 to 30		
	30 to 45		670
	45 to 60		710
	80 to 90		260
	0 to 5	30	160
	5 to 10	710	500
14th St.	10 to 30	2,090	2,040
	30 to 45	13,750	5,930
	45 to 60	3,640	4,220
	80 to 90	480	270
	0 to 5	10,420	2,760
	5 to 10	10,180	4,880
	10 to 30	278,790	205,880
	30 to 45	260,610	115,569
23rd St. ^{d/}	45 to 60	16,570	25,490
	80 to 90	1,570	1,530
	0 to 5	0	470
	5 to 10	0	3,370
	10 to 30	0	2,100
	30 to 45	130	7,620
	45 to 60	690	3,500
	80 to 90	570	230
34th St.	0 to 5	0	41,540
	5 to 10	110	2,380
	10 to 30	50	880
	30 to 45	150	3,330
	45 to 60	80	1,490
	80 to 90	40	1,460
	0 to 5	230	27
	5 to 10	220	430
42nd St.	10 to 30	3,300	20
	30 to 45	280	440
	45 to 60	330	230
	80 to 90	420	80
	0 to 5		
	5 to 10		
	10 to 30		
	30 to 45		
50th St.	45 to 60		
	80 to 90		
	0 to 5		
	5 to 10		
	10 to 30		
	30 to 45		
	45 to 60		
	80 to 90		

a. Eighth Avenue line, Thursday, 9 June 1966.

b. Air Sampling began at 0 minutes.

c. Calculated on human inhalation rate of 10 liters of air per minute.

d. Target Station; dissemination of B. subtilis from 0 to 45 minutes.

TABLE 8 ~~8~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS RIDING SUBWAY TRAINS, TEST III^{a/} (U)

Downtown Trains			Uptown Trains		
Route ^{b/}	Sampling Period, minutes ^{c/}	Organisms Inhaled Per Minute ^{d/}	Route ^{b/}	Sampling Period, minutes ^{c/}	Organisms Inhaled Per Minute ^{d/}
Express Train Riders			Express Train Riders		
42nd to 4th Sts.	22 to 27 68 to 71	5,070 1,630	4th to 42nd Sts.	1 to 7 40 to 45	3,180 20,000
Local Train Riders			Local Train Riders		
50th to 4th Sts.	0 to 9 25 to 33 46 to 56 72 to 80	6,700 40,720 8,470 330	4th to 50th Sts.	2 to 10 24 to 31 47 to 55 66 to 74	2,460 8,440 5,890 480
42nd to 23rd Sts.	0 to 7	1,730	14th to 23rd Sts.	31 to 35	7,400
34th to 23rd Sts.	1 to 7	2,840	4th to 23rd Sts.	33 to 39	26,770
23rd to 4th Sts.	15 to 23	15,900	23rd to 34th Sts.	45 to 49	15,740
23rd to 14th Sts.	15 to 19	9,260	23rd to 42nd Sts.	46 to 55	22,560

- a. Eighth Avenue line, Thursday, 9 June 1966.
- b. Sampler was operated from time of entry into boarding station until exit from destination station.
- c. Air sampling started at 0 minutes.
- d. Calculated on human breathing rate of 10 liters of air per minute.

TABLE 9. ~~TEST~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS IN SUBWAY STATIONS, TEST Va/ (U)

Station	Sampling Period, minutes ^{b/}	Organisms Inhaled Per Minute ^{c/}	
		Downtown Platform	Uptown Platform
Christopher St.	0 to 5	1,620	660
	5 to 15	3,070	1,970
	15 to 30	2,950	870
	30 to 45	1,650	870
	45 to 60	1,750	160
	80 to 90	6,670	50
	0 to 5	5,990	1,560
	5 to 15	2,940	3,800
	15 to 30	15,800	9,390
14th St.	30 to 45	8,540	3,720
	45 to 60	6,050	4,870
	80 to 90	540	190
	0 to 5	49,240	23,750
	5 to 15	1,004,110	121,820
	15 to 30	298,040	487,670
	30 to 45	101,960	93,790
	45 to 60	139,020	2,830
	80 to 90	3,940	NS
23rd St.	0 to 5	380	730
	5 to 15	2,720	6,660
	15 to 30	7,740	16,250
	30 to 45	7,110	13,720
	45 to 60	19,130	18,830
	80 to 90	1,830	7,650
	0 to 5	120	320
	5 to 15	1,520	13,600
	15 to 30	3,470	4,740
28th St.	30 to 45	4,080	1,520
	45 to 60	5,400	4,260
	80 to 90	1,440	490
	0 to 5	560	
	5 to 15	2,020	
	15 to 30	420	
	30 to 45	470	
	45 to 60	400	
	80 to 90	90	

a. Seventh Avenue line, Friday, 10 June 1966.
 b. Agent sampling started at 0 minutes.
 c. Calculated on human inhalation rate of 10 liters of air per minute.
 d. Target station; dissemination of B. subtilis from 0 to 45 minutes.

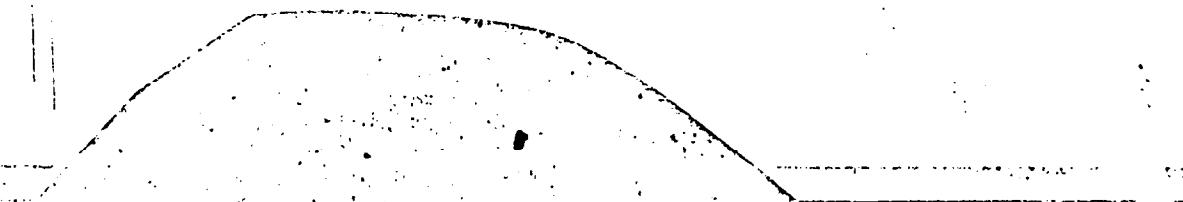


TABLE 10. ~~TEST~~ CALCULATED RESPIRATORY EXPOSURES,
PERSONS RIDING SUBWAY TRAINS, TEST V^a/ (U)

Downtown Trains			Uptown Trains		
Route ^b /	Sampling Period, minutes ^c /	Organisms Inhaled Per Minute ^d /	Route ^b /	Sampling Period, minutes ^c /	Organisms Inhaled Per Minute ^d /
Express Train Riders			Express Train Riders		
34th to 14th Sts.	4 to 7 32 to 35	11,350 1,680	14th to 34th Sts.	17 to 20 43 to 46	13,790 29,830
Local Train Riders			Local Train Riders		
34th to Chris.	3 to 9 15 to 20 35 to 41 46 to 51	16,530 53,500 8,790 34,050	Chris. to 34th Sts.	1 to 6 19 to 25 28 to 34 50 to 56	14,550 16,690 17,610 11,430
28th to 18th Sts.	0 to 3 15 to 17	195,860 15,670	18th to 28th Sts.	1 to 6	19,580
23rd to 14th Sts.	23 to 27	56,640	18th to 23rd Sts.	11 to 15	803,450
18th to Chris.	28 to 35	67,030	14th to 18th Sts.	35 to 40	42,010
			Chris. to 18th Sts.	46 to 50	28,540

a. Seventh Avenue line, Friday, 10 June 1966.

b. Sampler was operated from time of entry into boarding station until exit from destination station.

c. Agent sampling started at 0 minutes.

d. Calculated on human inhalation rate of 10 liters of air per minute.

APPENDIX D

(U) TEST PERSONNEL AND EXCERPTS FROM THEIR REPORTS

A. TEST PERSONNEL

The following personnel participated in the tests:

B. REPORT EXCERPTS

1. STA, Photographer:...

...Taking pictures in subway and outside of subway, in my opinion most people never noticed that anything unusual was going on. Some looked once and went on their way. I was asked by one man if I had taken any good pictures. I said yes and went on with my work.

2. NEB, Station Sampler

My sampling apparatus was a ID sampler installed inside a fancy looking camera case with a shoulder strap...While riding to and from sampling sites, I noticed quite a few people observing this case.

The first 2 days at my sampling sites...people all seemed to be in a hurry...I was able to walk off a short distance and exchange samplers without being noticed. The 3rd day...I noticed...a lady observing me exchange a sampler...but no questions asked. The 4th day a man watched me exchange a sampler...but...asked no questions. To my knowledge I did not see any person more than once at my sites the entire 4 days of operations.

3. CMC, Station Sampler

Test 1: Sitting on bench in 28th Street Station a man also sat on bench...began to look at box sampler case...then asked me what was making so much noise. I answered...the...radio. He seemed satisfied. A train came in and he caught it.

Test 3: Workmen in station noticed me change sampler...but said nothing and kept walking.

Test 5: Friday morning on a train...to our stations a man noticed the group...and asked where we got the cases. A companion replied at a hardware store...the man got off before we did.

Just before the end of the sixth sample a woman and a man...sat by me. She looked at my sampler...and asked what it was. He answered...that I was taking dust samples...trying to see how much dust...those workmen in the station...make. I kept reading my book.

On the whole, I do not think many people noticed the noise of the samplers or even the samplers.

4. WMC, Train Sampler

Testing procedures drew no attention or comments by anyone during the entire testing program.

5. WWD, Station Sampler

Most people showed only a passive interest in the sampling procedure and asked no questions other than directions. However, the operator of a news stand noticed I had been in the station for an extended length of time and after 2 hours and 15 minutes called me over to find out where I wanted to go and to help me find the right train. On the fourth and fifth tests I observed many policemen watching the crowd and making notes.

6. LCD, Station Sampler

...Reports that he was not aware at any time that he had attracted the attention of any other person.

7. REG, Train Recorder

I recorded train numbers and hygrometer readings in the subway stations without incident.

8. JAK, Station Sampler and Train Recorder

No one asked questions and insofar as I observed no one was curious about any activity associated with the tests. When not engaged in recording car numbers or taking samples, I leaned against a post and read the newspaper.

9. GWM, Station Sampler (Target Stations, Trials III and V)

During the entire sampling there was no attention paid to myself or to my sampling equipment.

In respect to the trials in which agent was disseminated through gratings...aerosol clouds were...momentarily visible in the station... when a train was leaving the station, the cloud was pulled down the tube after it...when one train was in the station, the cloud covered it... when the cloud engulfed people, they brushed their clothing, looked up at the grating apron and walked on.

10. JCM, Station Sampler

I was an air sampler operator stationed in subway stations during the five tests of the New York Subway system in June 1966. I used a Mighty Mite Air Sampler, a Humidity-Temperature meter, and in one test I monitored incoming and outgoing trains every few minutes. During all operations I had a Mighty Mite Air Sampler at my side.

At no time was I, to the best of my knowledge, under surveillance, or observed with any suspicion. Nor was I ever approached.

11. LAR, Agent Dissemination Operative

Dissemination - no suspicion of any kind was detected during drop portion.

Sampling - No suspicious visual inspection or questions caused by sampling.

My only contact with anyone was to answer questions of the type normally associated with transients, i.e., direction, time, etc.

12. RKS, Station Sampler

No questions other than requests for directions to various stations.

Some interest directed toward Mighty Mite, but no questions. One elderly lady appeared to follow me in Times Square Station but after a few minutes of walking down station and back up again, she got on the train and left.

At first sampling station (51st St.) while inserting Wagner sampler and turning Mighty Mite on, a man sitting on bench beside me leaned over and looked into case. No comment made; I looked at him as if to indicate he should mind his own business and he looked away.

13. TWS, Station Sampler

I was stopped by a police officer on the first day en route to my station, because I had a cigarette in my mouth.

Officer: Don't you know that you are not supposed to smoke in the subway?

Answer: No.

Officer: Where are you from?

Answer: Maryland.

Officer: Let me see some identification.

I had left all my identification papers at the hotel, and the only thing I had was the letter, so I showed him that. The officer looked at the heading and said you are not supposed to smoke on any public transportation. I said thank you and was on my way.

There were people who gave you the once-over or wanted to talk, but I went through the watch and writing act. That seemed to satisfy their curiosity, and I was too busy for conversation.

The people of the big city are moving too fast to see what is going on about them, and those that give you the once-over are satisfied as long as it looked legal on the surface.

14. LMT, Station Sampler

First Day: One policeman was seen on local and one policeman on express platforms during the first 45 minutes of sampling. The policeman on the express platform observed me closely several times, but said nothing.

Remaining Days: No untoward events occurred. Because of the no loitering law, I made it a point to be active in sampling, sitting down on a bench for about 30 minutes only during the last test. I found it helpful to leave the sampling area for a change of scenery during the break before the last samples were taken.

15. WBW, Station Sampler

Tuesday: Assigned to Grand Central Station with Mighty Mite. Learned several things, such as:

Turn sampler on/off while train is approaching. This kills the noise of sampler and people are watching the train anyway.

Stay on empty side of platform as though waiting for train; less conspicuous.

Become engrossed in newspaper or walk away when anyone shows interest in what you are doing. Saw several people look at Mighty Mite but no one questioned me.

Wednesday: Stayed around so long a conductor asked me if there was a particular train I was looking for. Mighty Mite was working at the time. I told him that I was trying to become familiar with the subway system, as the night before I had to ask three people how to get out to Shea Stadium. He gave me a map of the subway system, for which I thanked him without telling him I had one just like it in my pocket.

Thursday: While riding train to 23rd St Station, a man asked me where I got the nice little plastic case (The Mighty Mite). I told him all the hardware stores over town had them. He is going to buy one. No further interest shown in me or the operation.

16. GCY, Train Sampler/Agent Dissemination (Agent)

During the sampling phase no one at any time questioned or even gave a second look to observe any of my actions necessary to sampler operation.

During the dissemination phase, it was necessary to time the aerosol release carefully so as not to alert pedestrians in the vicinity. Reasonable care here completely eliminated any undue notice by people on the street.